ELECTRICAL REVIEW

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

(Formerly Review of Telegraph and Telephone.)

Vol. 2, No. 21. WEEKLY. | NEW YORK, THURSDAY, JULY 26, 1883. | $3 per Annum. Single Copies, 10 Cents.

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Entered at Post Office, New York, as Mail Matter of the Second Class.

Synchronized Clocks in New York City.

In our issue of May 24, 1883, we gave a diagram illustrating a "Railroad System of Synchronized Clocks," as operated by the Standard Time Company of New Haven, Conn.

We now call attention to the various diagrams *A, B, C* and *D*, showing in detail one of the patented devices used by the Standard Time Company, this particular device is known as the Lund Synchronizer and has long been most successfully used in London and throughout England by the London Standard Time and Telephone Company.

The description which follows is opportune, because, as mentioned in the former article, "Synchronized Clocks" are being rapidly introduced in business circles and with special success in New York City. Here all legitimate and really worthy enterprises achieve their greatest success, and, judging from the beginning made, there is a bright future for this, the only successful working system of giving uniform time.

No one familiar with the life of the modern man of business can fail to appreciate the importance of having correct time, even to very great exactness. And it is not remarkable that bankers and others who contract time obligations should look with favor upon any system that even promises uniformity of time; or that lawyers having cases set down for a definite hour should wish to be delivered from the disappointment of having a case adjourned, because of a difference in timepieces, which they can neither foresee nor control.

We have then here in the marvelous activity of the metropolis a growing demand for greater attention to the subject of time service. The querry is, can this demand be met?

No system can be satisfactory that does not, in the first place, aim to give scientifically accurate and uniform time; and in the second place, it must reduce to uniformity a large number of timepieces, by some method from which have been eliminated, so far as practicable, all known causes of interruption. And further, there must be that measure of careful supervision that shall inspire public confidence.

For many years electric clocks, electric dials, pneumatic dials and the like, have been, at first, very attractive and popular because of their noiseless and mysterious operation; but they have invariably been found to have this prime defect—that from time to time (and often more than once a day for some minutes at a time) they stop and cannot be started again till the cause of interruption has been discovered.

This arises because accidents can not be altogether avoided even in the most perfectly arranged system; and in any system of electric clocks or dials that has been invented, or that can be conceived, *an accident means an interruption.* An accident that it takes five minutes to discover and to remedy means an interruption of five minutes in marking the time, and the same with more serious accidents; and during these interruptions, those dependent on this time service are entirely without time.

Now, the Standard Time Company claims to fulfil the two conditions just named. They furnish accurate time, derived from authoritative astronomical observations, and they send out their signals from a regulator that is kept constantly within a very small fraction of a second of true mean time.

Further, these accurate time-signals, without any appreciable delay in transmission, correct the secondary clocks to uniform and exact time; the impulses do not actuate or drive the clock, but they simply control and adjust the minute pointer. The clocks are good independent timekeepers of themselves; hence an accident to the synchronizing or time-signal can cause no interruption in the going of the clock. The worst that can happen is, that if the regulating impulse be interrupted for twenty-four hours, the clock may indicate an error in time of a small fraction of a minute, which will be corrected the instant the synchronizing service is restored. The synchronizing signal goes over the line only once an hour or twice a day (as the case may be), and is of exceedingly short duration; so that the chances of interruption, even to the synchronizing current, are reduced to the lowest possible limit.

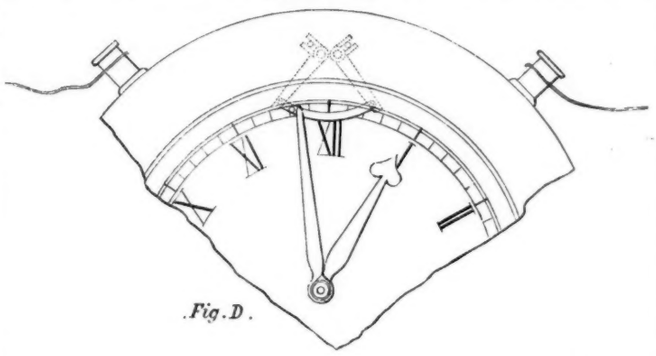


Fig. D.

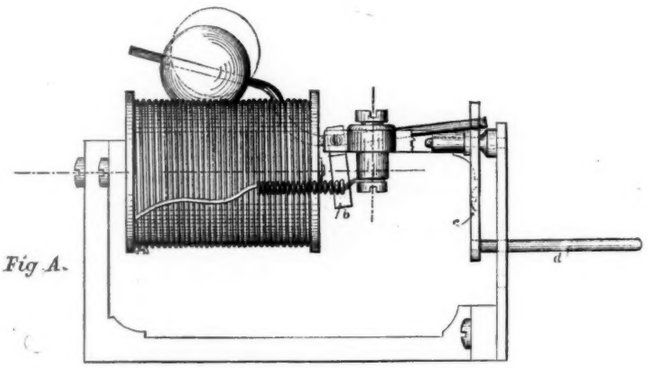
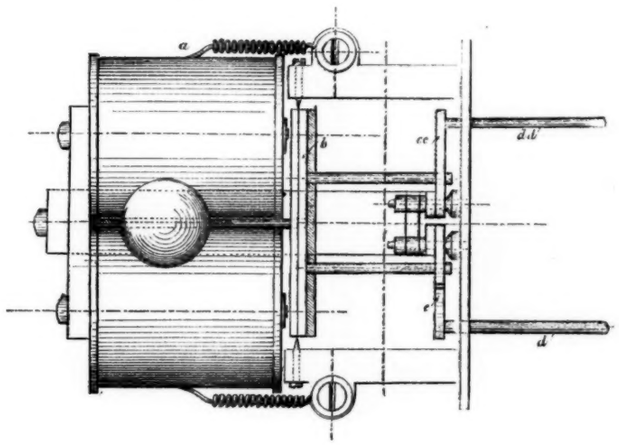


Fig A.



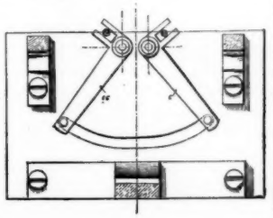


Fig. C.

A reference to the diagram will make the working of the synchronizing system easily understood.

A and *B* are the vertical and horizontal views of the synchronizer; and they show how, by the attraction of the armature *b*, power is transmitted through the arms *c* and *cc* to the pins *d* and *dd*, which set the minute hand. These pins, *d* and *dd*, thus close whenever the current passes over the line; when the current is broken and the armature *b* is released, the counter-balancing weight falls, causing *d* and *dd* to move rapidly and certainly back to their normal position of rest, so that the minute hand can pass to its next revolution. *C* and *D* give detailed views of of the arms that move the synchronizing pins and of the clock face as it appears when the hands are about to be set. The dotted lines indicate, as usual, the parts hidden from actual sight.

The whole device is compact in form, simple in construction, so arranged as to obtain the greatest power with least resistance, and is entirely disconnected from the movement of the clock.

The New Haven Clock Company, of 16 and 18 Park Place, are operating the systems of the Standard Time Company in this vicinity, and have built the first "time line," so as to include the banking districts of Broadway and Wall streets. Subscriptions have been received from the New York Clearing House, the Bank of America, the Chemical Bank, Hudnut's Pharmacy, the Department of Public Works, and many other banks and banking-houses on the line.

Everywhere the service has given great satisfaction, there having been absolutely no fault in the synchronizing signals since the opening of the line.

The clocks are handsomely constructed and of rich finish, being thus a great ornament to any office or building. They are of two sizes, twelve and fourteen-inch dials, and furnished in mahogany, walnut, ash or oak to suit the trimmings of the room in which they are to be hung.

This movement for introducing standard time has, therefore, passed the stage of experiment; it is an accomplished fact; it is a possible thing, and supplies a positive demand.

The New Haven Clock Company, with their usual enterprise, are first in the field in synchronizing clocks on a large scale in the

United States, and propose to push new lines all over the city as rapidly as the circuits and clocks can be constructed. The general management of the New York service is in charge of Mr. Hanford Crawford, of the Standard Time Company, whose office is with the New Haven Clock Company, 16 and 18 Park Place.

East India Electrical News.

7 COUNCIL-HOUSE STREET,
CALCUTTA, June 9, 1883.

Editor Electrical Review:

Since my last letter, the Oriental Telephone Company has formed a local company here to carry on their business on the same terms as before told you of the Bombay Telephone Company, and under the name of the "Bengal Telephone Company, Limited." The local company pays the London people the equivalent of $380,000 for their plant, patent, rights, etc., and sufficient stores of every kind to connect 128 subscribers to the central exchange, half in cash and half in shares fully paid up. The "patents" consist of a very questionable monopoly of the Edison, Bell, and Gower-Bell interests in India, or, properly speaking, Bengal. I should imagine, judging from the above, that the Oriental Telephone Company had done something, at least, towards paying a dividend to their shareholders, even taking into consideration the fact that they have guaranteed a dividend of four per cent. on the first issue of 5,000 shares for a period of four years.

We have had a most curious electric storm here for the last five days, commencing regularly every evening at 4.30 and going on up to 9. The lightning going on almost continuously from every quarter of the compass, and the thunder hardly ceasing for a moment. While this is going on, the telephone is of little or no use, as the currents on the wire drown every particle of sound, more particularly on the "calling wire" than any other, as it is much longer.

The Indian Electric Light Company (French), with Jablochkoff's arc and Swan's incandescent lamps and Gramme's dynamos, and the Eastern Electric Light Company, with Brush's and Lane-Fox's systems, monopolize all the lighting work up here.

The latter has done work only in Bombay and Rangoon, in both of which places it is, I belive, doing pretty well. In Rangoon it has got a contract with the municipality to light the whole town, which is a very small one, for $25,000 per annum. There is no gas in Rangoon.

The Indian Company is working all through the country, and is, I believe, doing a very good business "up country," which means in plain English, in the native principalities. Here in Calcutta all the cotton-mills, jute mills and presses are little by little adopting the system of electric lighting, and all that is really wanted to make the enterprise a real success, is a company that is prepared to supply good light at the lowest possible market rate, and to send out men who *understand their* business, and who are competent to work the machines under the trying circumstances, to which they are exposed in a country where the temperature varies so much and so constantly, as it does here; for instance, yesterday was a dry, hot day, the thermometer in my office showing 105° Far., to-day it is raining and the thermometer only shows 94° Far. The change may be as great to-morrow as at present. As far as I can make out, there is not a practical electrician in India who understands the electric light in the smallest degree. I am sorry I cannot send you more on this subject, but it is almost impossible to find out anything here.

I am now going to give you a "tip" for the American idea, and which if any of those brains we hear so much about out here, can do anything with, they will make their fortune ten or twelve times over.

Can they invent an automatic Punkah puller? A Punkah is a large fan hung in the center of a room by ropes from the ceiling, and is pulled by a native; and this is kept constantly going during the day to keep the room cool, and as it stands at present costs about $5 per month for labor. Can any one in that wonderful country devise a means of pulling this as cheaply and effectually? If they can, as I said before, their fortune is made

No more this mail from

Yours sincerely,
"BENGALI."

Wachusett Electric Light Company.

Manager M. Lee Ross sends the following interesting statement of the affairs of his company in Fitchburg, Mass., which are interesting as showing the rapid progress made by the American Electric and Illuminating Company, by their scheme of constructing plants, central lighting station and office, Water street, Fitchburg, Mass.

The officers of our company are: L. J. Brown, president; Wm. A. Hovey, vice-president; H. E. Irvine, treasurer; M. Lee Ross, general manager; and our board of directors are the following named gentlemen of Fitchburg and Boston: L. J. Brown, merchant, Fitchburg, Mass.; Walter A. Fairbanks, director Wachusett National Bank, Fitchburg, Mass.; James L. Chapman, treasurer Fitchburg Machine Works, Fitchburg, Mass.; Geo. E. Clifford, cashier Wachusett National Bank, Fitchburg, Mass.; M. Lee Ross, general manager, Fitchburg, Mass.; E. W. Burdett, of Messrs. Gooch & Burdett, attorneys-at-law, Boston, Mass; William A. Hovey, second vice-president American Electric and Illuminating Company, Boston, Mass.; Major C. S. Haldeman, alderman, Boston, Mass.; H. E. Irvine, treasurer American Electric and Illuminating Co., Boston, Mass.

This company has lately become a local organization and under the control of local management. As such it is prepared to supply electric lights in the city of Fitchburg from the company's central lighting station up to any required number, at reasonable rates.

The company is licensed to use the American system of electric arc lighting exclusively in the city of Fitchburg during the life of the patents. The system is now well known to the public, and the superior quality of the lights is universally admitted; as they are remarkable for brilliancy, pure white color, steadiness in burning, and absence of flickering and frying, so objectionable in the lights of other companies.

The Wachusett Electric Light Company is organized with a capitalization of $100,000, divided into 10,000 shares of $10 each. The stock is full paid and non-assessable. The company is well established and on a paying basis. It has a newly equipped central lighting station, with a 75-horse power Fitchburg engine, built expressly for this company, a new 80-horse power boiler, with Jarvis's patent furnaces, and six dynamo machines in place, with a capacity of 85 lamps of 2,000-candle power each. Ample room is provided for extension and enlargement of the facilities for lighting as fast as required by the public demand for the light. The lights are freely acknowledged by the public generally to be far superior to those of other systems.

The business of the company since its establishment has developed much faster than was at first anticipated, the demand for its electric lights far exceeding the expectations of the management, and everything now indicates that a plant of one hundred and fifty lights at least will be required within one year from the date of commencing business. The financial success of the enterprise is fully assured.

The newly-elected directors, appreciating the popularity of this system of illumination, and the great demands for the lights, have decided upon an enlargement of the present facilities sufficient to meet the same. Another boiler is to be added, another engine put in place, with corresponding increase in dynamo machines, lamps, with lines of wire and structures for same.

The directors have therefore decided to offer 2,000 shares of the treasury stock, at par, for ten days. People with surplus funds which are earning but 3 and 3½ per cent. will find this stock a good remunerative investment, with a moral certainty of receiving from 7 to 10 per cent., besides large increase in value of the stock. While all electric light companies operating in New England are to be commended for the energy displayed in the rapid development of their business, none have made greater strides in the way of extending their operations during the same period than the Wachusett Electric Light Company.

A recent important decision of the Commissioner of Patents in the telephone transmitter case has just been made public. The case came before the Commissioner of Appeal from a decision of the examiner of interferences in which a motion to reopen a case decided by him on March 16 last was denied. The case is that of Daniel Drawbaugh against Adolf Eccard, claiming priority of invention of telephone transmitter. The examiner of interferences in March last awarded priority of invention to Eccard, and subsequently Drawbaugh filed a motion for a reopening of the case on the strength of newly discovered evidence of the priority of his invention. The examiner of interferences refused to reopen the case on the ground that with reasonable diligence the appellant could have produced the alleged new evidence at the former hearing. The commisioner, in overruling this decision, holds that though it may appear that with proper diligence Drawbaugh might have produced this evidence at the last hearing of the case, yet that such a showing, while it would militate against his motion for a new trial in courts at law, cannot be held to prevent the reopening of the case in the Patent Office. The syllabus of the commissioner's decision is that, "as the questions to be decided in the Patent Office are, who is the prior inventor, and to whom should the patent be issued, it is necessary that the testimony material to establish who was the prior inventor and who first reduced the invention to practice should be received at any time before the patent issues. Where a case has been decided, however, on the testimony already taken, it will not be reopened for taking of further testimony, unless it be made to appear that such testimony, if introduced, will conclusively fix the date of the completed invention and thereby determine the question of priority. A motion for reopening a case or for a new trial in the Patent Office is not to be determined by the same rules which obtain in courts at law."

Process for Coating Steel with Copper.

Experiments are at present carried on in Belgium to preserve steel, and steel gun barrels in particular, by coating them thinly with copper by a process of which M. F. Weil is the inventor. Its peculiarity consists in the composition of the baths used, in which the usual and always dangerous cyanides of the alkalies are replaced by organic acids and glycerine.

According to M. Weil these baths require no renewal of organic elements, and can be used continuously when they are saturated with peroxide of copper. They possess also the advantage, owing to the property inherent in organic alkaloids of dissolving the peroxide of iron without attacking the metallic iron itself, of cleansing the steel before the commencement of the coppering process, and more perfectly than can be done mechanically. The coppering is effected by putting porous clay vessels filled with caustic soda lye, in which zinc plates have been immersed, in the basin containing the organic copper base (alkaloid) and the steel. The zinc plates are connected by a thick copper wire with the steel articles to be coated with copper. The caustic lye may be used over and over again. Should it become saturated with oxide of zinc, it is sufficient for its regeneration to treat it with sulphide of sodium, when the oxide (of zinc) will be precipitated and a by-product obtained by which the cost of the process will be considerably reduced. The coppering process, it is said, occupies but a very short time.—*Mechanics.*

The Phosphor-Bronze Smelting Company, 512 Arch street, Philadelphia, issue a circular calling attention to the valuable qualities of phosphor bronze wire, rods, sheets, bolts, etc. Phosphor-bronze is unequaled by other alloys in tensile strength, toughness, rigidity, elasticity, and resistance to crystallization and corrosion; being made entirely without the use of easily corroded metals such as zinc, the metal is not affected by rapid deterioration from galvanic action when exposed to dampness or the corrosive action of sea air, sea and mine water, and other like influences. These valuable qualities have led to the extensive use of phosphor-bronze as a substitute for iron, brass, copper, and German silver, in mining and marine pumps and machinery for piston rods, valves and valve stems, bolts and nuts, wire cloth, wire ropes, etc.; in electrical apparatus, for springs, screws, telephone and telegraph wire; in sanitary appliances, locks, hinges, wood screws, machine screws, hardware, and all purposes where great strength and durability are desirable. Detailed price lists furnished on application, and sample orders respectfully solicited. Address the Phosphor-Bronze Smelting Co., Limited, owners of the United States phosphor-bronze patents.

Accumulator Factory in Milan.

Mr. James Shepherd, of 45 Via Stella, and 3 Piazza Scala, Milan, has resigned his position as general agent of the Italian Edison Company, and has taken out a patent for an accumulator which he is now manufacturing on a somewhat extensive scale. We hope shortly to be able to furnish our readers with a description of same, as both the construction and results already obtained point to a decided success. Mr. Shepherd introduced both the Brush and Edison systems of electric lighting into Italy, and is the originator of the present Italian Syndicate. He also intends to act as agent for the introduction of any kind of machinery or apparatus used in connection with electric lighting or transmission of power, and we have no doubt that his efforts, united to his indomitable perseverance energy, and practical experience, will meet with success. Mr. Shepherd doubtless feels that electric light installations dependent upon machinery alone for their working are not altogether so reliable as could be desired. This we pointed out last week in our reference to the lighting of the Holborn Viaduct by the Edison system.

A New Regulator.

M. Tommasi has devised an apparatus intended to render the luminous point in the Jablochkoff candle fixed. The principle on which the inventor works is said to be the following: It is well known that selenium possesses the curious property of being a better conductor when it is influenced by light than when placed in darkness. On the other hand, the Jablochkoff candle has the disadvantage, by consuming exactly like an ordinary candle, and therefore of lowering progressively its luminous point. M Tommasi has invented a *selenium regulator*, suitably placed, which receives under certain conditions the light emitted by the Jablochkoff candle, and serves, so to speak, as an automatic elevator of the luminous point, which is regulated by its own light.

An experiment, made on the 2d of June, showed the sensitiveness of selenium to the electric light, as well as the instantaneousness of its variation of conductivity. A selenium regulator, constructed by MM. Th. and Alb. Dubosq, was placed in a dark chamber in the workshops of the Société de l'Eclairage Eclectrique. Submitted alternately to the action of the light of a Jablochkoff candle and of darkness, the selenium, traversed by the current from a powerful battery, showed well-marked differences of conductivity. It remains now for M. Tommasi to determine the practical arrangement which will fit this apparatus for commercial use. We understand that the device has been patented, and that M. Tommasi is now occupied in seeking for the best means of obtaining the maximum sensitiveness of the selenium, and that he is endeavoring to apply this body to photometry and telegraphy. For street lighting at all events we do not see much advantage in elevating the luminous point of the Jablochkoff candle.

The Development of Electric Lighting.

By J. E. H. Gordon, B. A.

DISCUSSION.

Mr. George Offor, manager of the South-Eastern Brush Electric Light and Power Company, while thanking Mr. Gordon for the valuable information he had given, said he should like to make a few observations on this interesting subject, being practically engaged as manager of electric lighting companies, and, therefore somewhat familiar with it. The real difficulty they had to contend with was not any indisposition on the part of the public to adopt the new mode of illumination, because they were now to a large extent familiar with it, and as to the question of price, they were already aware of the fact that it could, with a fair amount of lighting, be supplied at about the cost of gas. The difficulty experienced had been this, that they had not possessed the power to supply. They were now obtaining provisional orders under the Electric Lighting Act, but they had not got them yet; they had no power to take up the streets, and put down mains, to supply the public in the same easy way that they were supplied with gas. Twelve months ago there was a great champion of one particular system, and no doubt he had a great deal to do with the development of the industry within the last year or two, but he changed his views, and took up with a machine of the same character as had been described that night; and the public began to think if this champion has changed his views we had better pause before we put down plant which would require thousands of pounds. With regard to the system described to-night, it seemed in many respects defective. What was required in electric lighting, for domestic purposes, was a steady light which could be regulated without the aid of two men, however intelligent they may be, to watch whether the lights were being turned on, or turned off, and then to turn a wheel to regulate the speeds, to prevent too much or too little current going into the lamps. They wanted an automatic arrangement for keeping the lamps steady, and a constant supply, whether an engine broke down or not. Now, in the development of electric lighting, both these objects had been obtained. He had been running regulators at Colchester for some months, where he had turned off the lamps put on to a frame one by one, until he had only a single lamp burning, and that had been regulated entirely automatically, so that whether there were only one lamp or one hundred it would make no difference. This might be seen at Colchester at any time, where they were lighting a number of hotels and shops in the High street, and the business was increasing, because there they had the power of putting down mains, and supplying the public in the same way as they were supplied with gas. Then, were they sure, under the system of Mr. Gordon, to get a constant supply without any check by the breaking down of machines. It was true that, by the expenditure of a certain amount of capital, you might have a reserve machine, but a reserve machine of such a gigantic size meant a large amount of capital, and even that reserve machine could not be put into action at once if one of the others broke down, and if the bearings of both machines in connection broke down, the reserve would only take the place of one, and in any case there would be a certain delay. That difficulty was got over by the only way, in his humble judgment, which was suitable for domestic lighting, namely, by means of a storage battery. In that way, if a machine broke down, you had a supply of electricity to draw upon, and consequently, you might have the light day and night without keeping the station constantly going. Mr. Gordon had pointed out the advantage of the large machines, that you could dispense with the belt, but he was probably aware that there were steam-engines in connection with dynamos which ran direct without any belt. He might mention Hodson's rotary engine, which was running a dynamo without any bands, and there were many important engines with dynamos fixed to them, which ran in the same way. Again, something should be said in favor of small installations. When electric lighting involved such large figures and such very large machines, he was not at all surprised to hear that local authorities suggested that a trial on so large a scale should be made at the risk, in the first instance, of those who believed in it. He believed the great bulk of the business they were likely to do for some time would consist of small installations, beginning with 100, 200 or 300 lamps and increasing gradually. How did gas companies supply a town? By means of large gas holders from which they drew all that was required, and that was what his company promised to do; viz., by a storage system establish in different parts of the town and from that, drawing off, as from gasometers, the supply of current required by the public.

Mr. Gordon had pointed out that, under his system, the lighting station should not be at any great distance from the supply, but that was not necessary under the system of the companies he managed. Their stations might be many miles away, the only inconvenience being the length of wire required to connect the stations with the storage batteries; but, by the use of a high-tension machine the current could be conveyed a long distance at a very moderate expense, so that they did not need to bring the lighting stations into the more expensive parts of the town, or to create a nuisance there, however unimportant. He had had the dynamo running for many months and had received no complaints even from the neighbors. He had also had offices lit for the last eight months by means of the storage system. He believed there was a great future for electric lighting, because they were now obtaining powers under the act.

The companies he represented had already agreed with local authorities and the board of trade for provisional orders for fourteen towns, and as soon as the necessary act of Parliament was passed, the arrangements would be carried out. He knew from observations and inquiry that the public were quite ready to take the new illuminant as soon as they were able to supply it in the same simple effective way that gas was supplied.

Mr. C. G. Gumpel said he must agree with Mr. Gordon that the greatest difficulty electric lighting had had to contend with was stock jobbery. What had caused the indifference shown to electric lighting was not the want of powers which Parliament had withheld, but chiefly the absolute loss which had been brought about by speculators. When they heard of the large sums which had been given to electric companies by the public, he would remind them that those sums were not paid to inventors, but were paid to promoters—to men who were the intermediaries between the practical men and the investor. He thought the history of this speculation ought to be written as a warning to future undertakings. We lived in a very different age to that of 80 years ago, when gas first made its appearance, and did now in five years what was then done in thirty. The first speaker had referred to an automatic regulator, and there was no question that they required it. At the present time there was no practical regulator in the market. Professors still spoke about dynamos which kept a constant potential at their terminals, and one suggested one plan and one another, but those acquainted with electrical literature would know how many different plans had been adapted. When the doctors themselves did not agree, what could be done? Mr. Gordon never said a truer word than when he referred to the necessity of making the plant of such a size that lighting could practically be introduced.

It must be remembered that in introducing electricity they had to compete with gas, where one large gas-works supplied a whole town, and the question was to give the plant such a form as to take from a single engine enough power to supply the light required. They did not want small installations, for which it would be easy to devise small machines, and when they were recommended he imagined the wish was father to the thought. They wanted larger installations, because you could get them cheaper, as had been shown in the figures. Every electrician knew that. It was the same with gas. Mr Gordon had solved the one great question of making a machine large enough to supply a town of medium size, and whenever the history of electric lighting was written, his name would stand forward as one who had shown the way.

With regard to the storage battery, Mr. Offor was connected with the company which supported cumulative batteries, and hence it was necessary that he should advocate them; but Prof. Lodge, in that room a few days ago, speaking of the nature of storage batteries, said they were all very nice as long as you used them. You might charge them and discharge them, and they would act as long as you did so, but you must not let them stand. If you let them stand for any length of time, you required a very strong current to break through that thick coating of sulphate of lead which was formed on them, making an insulator which you could not penetrate. Suppose you had a battery in a house, and went out of town for a few weeks, and let it stand; when you came back and turned on the lights the battery would not charge, and you might wait until doomsday, but you would not get a current into it or out of it. He believed there were points connected with batteries which would make it a long time before their manufacture took a practical form. He had worked at the subject for five months, and had met with many drawbacks in their working.

Mr. Rawson said the figures which had been given were most valuable, and when they appeared in print must strike the public, especially in many places, particularly abroad, where gas cost 20s a thousand cubic feet; it would lead people to inquire and see if there was not something in electric lighting. He would remark that it was not the price of the current, but the price of the light, which was important, and the question was what you could get out of the lamps. If with a certain current you could double the illuminating power, you at once reduced the cost 50 per cent. Up to the present time incandescent lamps had not been worked at so much as the other parts of the plant, and there was no doubt they would be greatly improved, so that with a certain current a lamp of a greater power would be obtained and the price of the lamp reduced. They would then be able to run lamps with much higher candle-power. An ordinary lamp would now give twenty candle-power, with seventy volts-amperes, and last 2,000 hours; but if the price of the lamp could be reduced you could afford to work it for only 1,000 hours, and could get so much more light. The price of gas would, no doubt, come down; and the products which now fetched a good deal of money, if gas were less used, would become higher, and, therefore, electric lighting would have still further competition to meet.

Mr. Gordon, in reply, said he had listened with a great deal of interest to the remarks which had been made, and it was very useful to hear the views of other persons acquainted with the subject. With regard to the question of Stock Exchange operations, he did not think that was the place to discuss it. All he could say was, he did not agree with Mr. Offor, and nothing he had said had caused him to alter his opinion. He must leave it to the audience to say whether wild and reckless speculation, not in electric lighting, but in paper shares representing electric lighting, was likely to cause the public to adopt it as a safe and steady investment. With regard to the controversy between high and low speed dynamos, it had been going on for a long time, and was not finished yet, and it would probably take some years of work before the question was thoroughly decided. He was speaking chiefly not of what was used in small installations, but what was wanted on a large scale to compete with gas. With regard to driving direct from high-speed engines, he had seen nearly all such engines which were made, and there were plenty which would work very nicely, but he never saw a high-speed steam engine which worked 500 revolutions—and the "Hodson" worked 1,500—that would be guaranteed for a year. He stood near one the other day for a few minutes, working at about 1,200 or 1,500 revolutions, and the noise was extraordinary; the whole place shook and rattled, and you felt, although it might last six months, or perhaps one year or two, the item on depreciation of plant of that kind would be something like ten times what he had put down. He believed he had been the only electrical engineer in England who had persistently said that storage batteries were worthless on a large scale. Storage was not analogous to pumping gas into gas reservoirs. You could not store electricity; you stored energy, and the analogy to storing energy was winding up a spring or pumping up water to a high cistern. Suppose you had a steam engine which worked a quantity of machinery in a large factory, what would be thought if some one came to you and said if your engine broke down the shop must stop, so you must have storage; and told you to take off the belt, use the engine to pump water into a high reservoir, and let the water run down again, and turn a turbine and drive a shaft, and then you would be sure not to break down; they would not think much of the practical nature of such advice; and if he added you must pump it into a cistern which leaks very badly, they would think still worse of him. Storage certainly has its uses, particularly in small plant. If you had a little plant in a country house, where the steam-engine which did the pumping did a little electric lighting, and the wages of the engine driver would double or treble the expense, and you wanted the gardener to attend to it, who went home at 6 o'clock, then have storage; because if you lost half or two-thirds it did not matter, it would be cheaper than paying an engine-driver. But when you had plant of the size to compete with gas, you could afford to have men up all night. A question had been asked what would be the state of a storage battery after 2,000 hours. He had never heard of one which had worked 2,000 hours. With regard to capital expenditure, a point was made that a spare machine meant expenditure, and, therefore, storage batteries ought to be used instead, but the best storage batteries now in the market, capable of storing up current for 5,000 lamps, would cost more than a spare machine, he should think probably two or three times as much. As to regulation, he might say that all through the paper he had spoken, not of what they hoped would succeed, but what was actually practical. He had every hope that they would yet have automatic regulators and he had experiments now going on, but he did not feel justified in speaking of this as an accomplished fact until they had succeeded. If anybody would bring them a first-rate automatic regulator, they would be glad, if they found it useful, to adopt it, and pay royalty on it; the market was open to anybody at present. He was not aware of any regulator which worked perfectly with a large machine, so he had thought it better to discuss the matter, assuming the more expensive method, if hand regulation was to be adopted. With a small machine, automatic regulation was very useful and important, but with big machinery it was not always the wisest thing. In their experience at Greenwich, of coiling submarine cables into tanks, it was found better that it should be done by hand. They had tried a number of different patents for automatic coiling machines, but had not adopted any of them. If you wanted to reel cotton, you must regulate the flow by machinery, because you could not afford a man to each reel; but with a cable of the value of £50,000, a man more or less did not matter very much, and very often the expediency came in which made them decide to use hand regulation in preference. Still they had no prejudice, and were perfectly ready to employ automatic regulation if it were perfectly certain, and did not require a man to watch it. The question of incandescent lamps was very important and interesting, and he had all manner of hopes about the future, but he did

not want the public to think that electric lighting people were mad, and if he told them what he believed would be done in the future they would not believe him; therefore he preferred to speak of what was actually accomplished, so in the capital expenditure he spoke not of estimates, but of actual tenders. It was perfectly certain that every improvement in the lamps was a direct gain to electric lighting companies and the public. Engines, dynamos, mains, transferred the energy of coal or water into electricity, and the more perfect the dynamo, the more electricity you obtained for so much fuel. But then before electricity came to be of any use to the public it had to be changed again into light, and the quantity of that light produced depended on the lamp. The cost of the light depended on the amount of energy consumed, and that depended on the temperature which the filament would stand; the higher you could raise the temperature the higher would be the candle-power per horse-power. To give a simple illustration, if you took a red-hot poker into a room, there was a great deal of energy but very little light; but if you had a little platinum spiral made white-hot, there would not be one-tenth the energy, but much more light. Step by step, as the manufacture of lamps advanced, they would be able to work them at a higher temperature and still be able to guarantee them for 2,000 hours, and with every step of that kind there would be a great gain. Therefore, they were looking forward to the perfecting of the lamp as a means of perfecting electric lighting, and meeting every reduction in price which the gas companies would make. He had endeavored to speak not of these fascinating expectations they all indulged in, but what was required for a plant which a responsible company was now prepared not only to erect, but to guarantee the successful working of.

The vote of thanks was carried unanimously.

The Storage of Wind Power.

"W. O. A.," in the *Scientific American*, says: The great question of all questions of the present day, in the line of invention and mechanical application, is, How can we best turn to account the natural forces which are in play about us? Setting aside for the present the direct use of electricity as a motive power, we have two fluids at our command, air and water. Both have from time immemorial been pressed into the service of man, and yet even at this moment, with all the modern advances in practical science, we are only on the threshold of the workshop in which we ought to have full command. It is not too much to say that of the power exerted by the movements of water and of air throughout the world, the percentage utilized is so small as to be practically inappreciable. Let our inventors look to this, for it is a field which promises well.

The idea of using the power of water-falls at a distance, transmitting the energy by means of—say compressed air, or electric wires—has been often suggested and tried, but thus far with no very satisfactory results. The loss of power through the agents employed in transmission has been so great as to much impair the economic value. But let us take up another line of thought, and see if we cannot start some inventive brain into a plan which will bring out something practical. The power to which reference is made needs no transportation; it is ready at hand; it is simply the wind.

It seems incomprehensible that such a ready and potent agent should escape practical use so completely as it does. The probable reason for this is that the power is destitute of all uniformity, and has on that account hitherto been deemed unmanageable; sometimes furious, sometimes absolutely nothing, and at all times unsteady and capricious.

Before referring again to this feature, let us estimate for a moment the amount of power at our command, within a given space, if we can only control and utilize it. We will assume an area 40x150 feet, no larger than the flat top of many a manufacturing establishment, store, &c. Within this extent it is entirely practicable to place 32 wind-wheels, each 12 feet high by 8 feet diameter, and so arrange them that each shall have full sweep of the wind from whatever quarter it may blow. The wheels here contemplated would revolve on vertical axles—or horizontal if preferred—with fixed blades, one-half shielded and turning so as to suit the direction of current. They would need no attendance, no brake, no check, let them spin with the utmost fury of a gale or lie still in a calm. Rapid motion could do no harm, only increasing their efficiency; whenever they turned they would do work, when they lay still they would do nothing. Each wheel would drive an air-pump of size suited to its power, and each stroke of the piston would send its given quantity of air into the common reservoir provided. That reservoir becomes then a magazine of compressed air whose energy is reported by the gauge, and is used by any of the means now so well known.

A wind-wheel of the size stated carries on each of its blades a surface of 48 feet. The pressure of wind in what is known as a "strong breeze" is about 2 lbs. per square foot, and its rate of motion about 1,750 feet per minute. It is easy to see, therefore, that theoretically the efficiency of such a wheel in such a wind is safely reckoned at 5-horse power.

But here comes in the difficulty, and it is *the* difficulty of all and must be overcome, or this power is of practically no value in the line of which we have been speaking. The power is capricious, and unless we can steady it no form of business can depend on it for service. How shall we *store* the power that may come to us by day or by night, Sundays and week days, gathering it at the time when we do not need it and preserving it till we do? This is the problem. Who is the man to solve it? Surely it should not be set aside as too difficult for trial.

Why should it not be dynamized into electricity? No distant transmission, with its loss of energy, comes into play, for a line of shafting can be driven directly on the spot. It is true, the whole field of electric storage is yet too little explored to answer this question on the instant, but is it not worth considering?

Other modes of turning to account the compressed air, and using it only as needed, are also within our reach.

A factory or other building, of the size already given, with the wind-wheels on its roof, taking the average rate of the wind as it is known to be in our region and climate, has at its command, if it can *store* the power, at a fair and moderate estimate, 4,200 horse-power per week, thus giving it a 70 horse-power engine for six days of ten hours each. And this power is without engineer, without fuel, without labor, practically without expense.

Store the wind power, and render it of even application, and all this is perfectly possible. Shall we admit that this cannot be done?

Extensive Plans for Electric Lighting.

The directors of the American Electric and Illuminating Company met to-day (July 10) and selected the following officers for the ensuing year:

Edward H. Goff, President and General Manager; Silas Gurney, First Vice-President; Wm A. Hovey, Second Vice-President; H. E. Irvine, Treasurer; Samuel Elder, Secretary; C. D Smith, General Superintendent of Construction; E. J. Welch, Electrician.

The management state that they have so far matured plans for the coming 12 months that orders for the necessary supplies have been placed with the manufactories to supply engines, boilers, dynamos, lamps and copper wire to equip the following plants, viz.: 250 lights additional in Boston, making a full 600-light plant in this city; 50 additional lights in Lowell, making 150 there; 50 additional lights in Fitchburg, making 150 in all; 100 additional lights in Hartford, Conn., making a 200-light plant there; 50 additional lights for Cottage City, Martha's Vineyard, making 100 there; 50 additional lights for Old Orchard Beach, Me., making 100 there; thus aggregating 550 additional lights for plants already established.

For new stations now under construction or to be established during the coming year: A 1,000-light station for New York City; a 200-light plant for Providence, R. I.; 150 lights for Worcester, 100 for Springfield, 100 for New Haven, Conn., 100 for Bridgeport, Conn., 300 for East Boston, Chelsea, Malden and Revere Beach, with central station at Chelsea, 100 for Cambridge and part of Somerville, 100 for Lawrence, 100 for Nashua, N. H., 100 for Manchester, N. H., 100 for Saco and Biddeford, Me., 100 for Portland, Me., 100 for Lewiston, Me., 100 for Augusta, Me., and 100 for Bar Harbor, Me., making an aggregate of 3,400 lights in central stations, besides several smaller stations talked of and a number of isolated plants for mills, shops, &c. The material required will be about 150 25-light dynamos, 75 50-horse power engines and at least 600 miles of copper wire. —*Boston Advertiser.*

The Thomson-Houston electric light is rapidly coming to the front and will doubtless see this excellent system among the leading competitors for public favor in the near future. Many of our readers will imagine that this statement is exaggerated somewhat, and that the efforts of this company to locate plants has been confined exclusively to the East. This is not a fact, however, as those who witnessed their display at the Chicago Exposition can amply prove, nor to those familiar with the energetic work of this company. We note with pleasure some of the larger plants using the Thomson-Houston systems with the number of lamps in circuit: Fall River, 77; Woonsocket, 26; Salem, 26, Haverhill, 87; Lynn, 92; Utica, N. Y., 50; Leavenworth, Kan., 50; Peoria, Ill., 100, and Kansas City, Mo., 110

Public Obligations of Telegraph Companies.

In one of its aspects the strike of telegraph operators is merely a matter between employer and employed—between the Western Union Company and its employes. But in another and a far more important aspect it may become a vital issue between the company and the public.

There is no law in this country against peaceable and orderly labor strikes, and there ought not to be any. Every working man has a right to demand for his services what he thinks they are worth, or more if he pleases, and he has a right to quit work if he does not get what he asks. Every employer has the reciprocal right to get laborers, skilled or unskilled, on his own terms, if he can. When his employes become dissatisfied and strike for higher pay, he is at liberty to deny their demand, and if they quit work to refuse to take them back on any terms. If working men want to agree among themselves to demand more pay for their services, they have that right, and employers are at equal liberty to combine against the demands of employes.

These are elementary principles of the law of labor; they are fundamental principles of the law of the land. They are recognized and sanctioned by the Penal Code of this State, which declares that "the orderly and peaceable assembling or co-operation of persons employed in any calling, trade or handicraft for the purpose of obtaining an advance in the rate of wages or compensation, or of maintaining such rate, is not a conspiracy," and hence not unlawful. A law which would deny to persons employed the right to demand what pay they please and to refuse to work, if they choose to do so, unless they get what they ask, would make every working man a slave, and give to every employer the powers of a tyrant.

These principles apply to the threatened telegraph strike, so far as the relations between the company and its employes are alone concerned. The operators have a perfect right to demand what they consider a fair compensation for their services, and to refuse to work unless they get what they ask. The company is entitled to refuse these demands, and to employ other operators to take the place of the strikers.

But there is another aspect of the matter. The company has its obligations and owes its duties to the public. In its ownership it is a private corporation; in its business and its duties it is a public corporation. It came into existence and exists only by leave of the State. It derived from the people its valuable franchises and privileges—the right to plant its poles and construct its lines on public and private property, to run its wires across navigatable waters and through the streets of cities. It was chartered to serve the people and to do a public business. As the Supreme Court of the United States said in a recent case, "the telegraph has changed the habits of business and become one of the necessities of commerce. It is indispensable as a means of intercommunication. Goods are sold and money paid upon telegraphic orders. Contracts are made by telegraphic correspondence; cargoes secured and the movements of ships directed. The telegraphic announcement of the markets abroad regulates prices at home, and a prudent merchant rarely enters upon an important transaction without using the telegraph freely to secure information." Railroad travel is governed by telegraph, and hence the very lives of the people are dependent upon its operation. In short, telegraphic communication is interwoven with the entire industrial, commercial and social fabric of the country. It is a necessity to the people.

In view of these considerations there are imposed upon a great telegraph company obligations to the public which cannot be disregarded, and duties which cannot be neglected. It is bound to give the people never failing facilities for communication. It cannot close its offices and stop its instruments for any cause which human foresight and diligence can overcome. A strike of its employes is no excuse in law for any unreasonable cessation of its service. It may refuse the demands of the strikers, but it must procure other operators to take their place without unreasonable delay. It is not only bound to fulfil its paramount obligations and discharge its duties to the public by keeping up its service, but it can be compelled to do so by the courts.

The law to this effect has been clearly, explicitly and emphatically declared by the Supreme Court in the case of the railroad strike of last summer. "We cannot bring our minds to entertain a doubt," said the Court, "that a railroad corporation is compellable by a mandamus to exercise its duties as a carrier of freight and passengers, and that the power so to compel it rests equally firmly on the ground that that duty is a public trust, which, having been conferred by the State and accepted by the corporation, may be enforced for the public benefit." As to the strike, the Court held that so long as the workmen committed "no unlawful act, no violence, no riot, and no unlawful interference with other employes," they had a right to strike. "Can railroad corporations," it then asked, "refuse or neglect to perform their public duties upon a controversy with their employes over the cost or expense of doing them? We think this question admits of but one answer. The excuse has in law no validity. The duties imposed must be discharged at whatever cost. They cannot be laid down or abandoned or suspended without the legally expressed consent of the State. The trusts are active, potential and imperative, and must be executed until lawfully surrendered, otherwise a public highway of great utility is closed or obstructed without any process recognized by law. This is something no public officer charged with the same trusts and duties in regard to other public highways can do, without subjecting himself to mandamus or indictment."

These principles and this law are as applicable to a telegraph as to a railroad corporation. The obligations and duties of each to the public are alike. In neither case is a strike of employes any excuse for failure to perform those duties. The public interests are paramount, and must be regarded.—*N. Y. Herald.*

In accordance with a promise made in a recent number, we publish below a table of French weights and measures, for the convenience of our readers. It may be found useful on many occasions, if cut out and the slip carried in the pocket-book for ready reference. ED. REVIEW.

FRENCH METRICAL SYSTEM OF WEIGHTS AND MEASURES.

The metrical system is based upon the length of the fourth part of a terrestrial meridian. The ten-millionth part of this arc was chosen as the unit of measures of length, and called the *Metre*. The cube of the tenth part of the metre was adopted as the unit of capacity, and called the *Litre*. The weight of a litre of distilled water at its greatest density was called a *Kilogramme*, of which the one-thousandth part, or *Gramme*, was adopted as the unit of weight. The multiples of these, proceeding in decimal progression, are distinguished by the employment of the prefixes *deca*, *hecto*, *kilo*, and *myria*, from the Greek, and the subdivisions by *deci*, *centi*, and *milli*, from the Latin.

MEASURES OF LENGTH. UNIT, 1 METRE.

	Inches.	Feet.	Yards.	Miles
Millimetre, equal to	0.03937	0.003281	0.0010936	0.0000006
Centimetre, "	0.39371	0.032809	0.0109363	0.0000062
Decimetre, "	3.93708	0.328090	0.1093633	0.0000621
METRE, "	39.3709	3.280899	1.0936331	0.0006214
Decametre, "	393.7090	32.809082	10.9363306	0.0062138
Hectometre, "	3937.07900	328.089017	109.3633056	0.0621382
Kilometre, "	39370.79000	3280.899167	1093.6330556	0.6213824
Myriametre, "	393707.90000	32808.991667	10936.3305556	6.2138242

Where exactness is not required, the following easily-remembered approximations are convenient to be used, but it should be observed that, as they are only approximations, the errors in them are increased by multiplication:

1 millimetre is about three-hundredths of an inch;
1 centimetre is about one-third of an inch;
1 metre is about 3 inches more than 1 yard; and,
1 kilometre is about five-eights of a mile.

CUBIC, OR MEASURES OF CAPACITY. UNIT, 1 LITRE.

	Cubic Inches.	Cubic Feet.	Pints.	Gallons.
Millilitre, or cubic centimetre, equal to	0.06103	0.000035	0.00176	0.0002201
Centilitre, 10 cubic centimetres, "	0.61027	0.000353	0.01761	0.0022010
Décilitre, 100 cubic centimetres, "	6.10271	0.003532	0.17608	0.0220097
LITRE, or cubic decimetre, "	61.02705	0.035317	1.76077	0.2200967
Décalitre, or centistère, "	610.27052	0.353166	17.60773	2.2009668
Hectolitre, or décistère, "	6102.70515	3.531658	176.07734	22.0096677
Kilolitre, or Stère, or cubic metre, "	61027.05152	35.316581	1760.77341	220.0966767
Myrialitre, or décastère, "	610270.51519	353.165807	17607.73414	2200.9667675

The only close approximation in this table to any English measure is that 1 litre is about equal to one-fifth of a gallon. Therefore the average claret and whiskey bottles in common use hold about 1 litre.

The hectolitre, commonly used in France for measuring flour, is about 22 gallons.

MEASURES OF WEIGHT. UNIT, 1 GRAMME.

	Grains.	Troy oz.	Avoirdupois lbs.
Milligramme, equal to . . .	0.01543	0 0.0032	0.0000022
Centigramme, " . . .	0.15432	0.000322	0.0000220
Décigramme, " . . .	1.54323	0.003215	0.0002205
GRAMME, " . . .	15.43235	0.032151	0.0022046
Décagramme, " . . .	154.32349	0.321507	0.0220462
Hectogramme, " . . .	1543.23488	3.215073	0.2204621
Kilogramme, " . . .	15432.34880	32.150727	2.2046213
Myriagramme, " . . .	154323.48800	321.507267	22.0462126

The weight most commonly met with in electrical books and journals, the kilogramme, weighs about two and two-tenths pounds avoirdupois.

SQUARE MEASURES. UNIT, 1 ARE.

	Square Feet.	Square Yards.	Acres.
Centiare, or square metre, equal to	10.764299	1.196033	0.0002471
ARE, or 100 square metres, "	1076.429934	119.603326	0.0247114
Hectare, or 10,000 squares metres, equal to	107642.993419	11960.332602	2.4711431

One are is, therefore, about one-fifth of an acre.

TABLE FOR CONVERSION OF METRIC WEIGHTS AND MEASURES INTO ENGLISH.

Metres into	yds.	Kilometres into	miles & yds.
1	1.094	1	0 1094
2	2.187	2	1 427
3	3.281	3	1 1521
4	4.374	4	2 855
5	5.468	5	3 188
6	6.562	6	3 1282
7	7.655	7	4 615
8	8.749	8	4 1709
9	9.843	9	5 1043
10	10 936	10	6 376
20	21.873	20	12 753
30	32 809	30	18 1129
40	43.745	40	24 1505
50	54.682	50	31 122
60	65.618	60	37 498
70	76 554	70	43 874
80	87.491	80	49 1251
90	98.427	90	55 1627
100	109 363	100	62 243
200	218.727	200	124 487
300	328.090	300	186 730
400	437.453	400	248 973
500	546.816	500	310 1217

Litres into	galls.	& qts.	Kilogrammes into	avoirdupois lbs.	& ozs.
1	0	0.880	1	2	3¼
2	0	1.761	2	4	6½
3	0	2.641	3	6	9¾
4	0	3.521	4	8	13
5	1	0.402	5	11	0¼
6	1	1.282	6	13	3½
7	1	2.163	7	15	7
8	1	3.043	8	17	10¼
9	1	3.923	9	19	13½
10	2	0.804	10	22	0¾
20	4	1.608	20	44	1½
30	6	2.412	30	76	2¼
40	8	3.215	40	88	3
50	11	0.019	50	110	3¾
60	13	0.823	60	132	4½
70	15	1.627	70	154	5¼
80	17	2.431	80	176	6
90	19	3.235	90	198	6½
100	22	0.039	100	220	7
200	44	0.077	200	440	14
300	66	0.116	300	661	6
400	88	0.155	400	881	13
500	110	0.193	500	1102	5

Cincinnati Industrial Exposition.

The management of this interesting and permanent institution are making strenuous efforts to have the coming annual Exposition excel any that has yet taken place. Their prospectuses, containing the rules, regulations and premiums, should be in the hands of every inventor, electrician, manufacturer of electrical appliances, and especially every electric light or power company, and can be procured by writing to Mr. Wm. H. Stewart, secretary.

The Exposition opens on Wednesday, September 5th, and will continue until Saturday, October 6th, just one day over a full month. Exhibitors are urged to send to the management an outline of their plans and space required, and any information they may find necessary to secure good positions for their exhibits. The medals offered are very valuable, and should call out competition from all branches of electrical science and invention.

The first electric locomotive was invented by a Swedish engineer, Herr H. Wesslau, in the employ of Siemen & Halske, of Berlin. This was proved last year by the latter when claiming a patent for their machine in America, which was then opposed by Edison. The document to this effect, now in the Patent Office in Washington, sworn to by the American Consul in Berlin, sets forth that the first drawing to their engine was made by Herr Wesslau in September, 1878, while Edison's was not made until November, 1879. Herr Wesslau is a native of Holland, in Sweden, and has for many years been employed in some of the leading German engineering works.

A company has been formed in London for the construction and working of an electric railway under the River Thames, through iron caissons. It will be worked by means of a stationary engine, transmitting the power to the carriages, which will run separately, start as soon as filled, and occupy about three and a half minutes in the journey.

Human Electrical Machine.

Dr. S. C. Woodman relates in a late number of the *Michigan Medical News* some remarkable particulars concerning a young man who appears to be a storehouse of electricity. His name is William Underwood, his age is about 27 years, and his extraordinary gift is that of generating fire through the medium of his breath, assisted by the action of his hands. Underwood will take anybody's handkerchief and hold it to his mouth, rub it vigorously with his hands while breathing on it, and immediately it bursts into flames and burns until consumed. He will strip, and rinse out his mouth thoroughly, wash his hands, and submit to the most rigid examination to preclude the possibility of any humbug, and then by his breath blown upon any paper or cloth, envelop it in flame. He will, when out gunning and without matches, desirous of a fire, lie down, after collecting dry leaves, and by breathing on them start a fire, and then coolly take off his wet stockings and dry them. It is impossible to persuade him to do it more than twice a day, and the effort is attended with the most extreme exhaustion. He will sink into a chair after doing it, and on one occasion, after he had a newspaper on fire, Dr. Woodman placed his hand on his head and discovered his scalp to be violently twitching, as if under intense excitement. He will do it at any time, no matter where he is, under any circumstances; and Dr. Woodman has repeatedly known of his sitting back from the dinner table, taking a draught of water, and by blowing on his napkin at once set it on fire. Underwood is ignorant, and says that he first discovered his strange power by inhaling and exhaling on a perfumed handkerchief that suddenly burned while in his hands.

Accumulators.

Engineering says: An interesting lecture-room experiment, for illustrating the action of accumulators batteries has recently been made by Messrs. J. Elster and Hans Geitel, of Wolfenbuettel. If the poles of a dry battery of the Zamboni type are connected with the electrodes of a Holtz induction machine and the pile charged for about ten minutes, it will for several hours act as a miniature accumulator. Messrs. Elster and Geitel used an ordinary tin and copper pile of 11,000 pairs, with plates of one centimetre square, suspended for convenience on a silk thread. The strength of this pile, which under ordinary circumstances would hardly have been appreciable, was so increased as to give sparks of one millimetre in length, and to work a small Geissler tube. This suggested the use of a dry Plante-Faure battery, which was made by placing lead foil discs between paper discs, of which one was saturated with oxide of lead and some silicate of potash was added to make the plate adhere. This battery worked well in a moist atmosphere, and retained traces of its charge for fully twenty-four hours. Another, prepared with minium and lead oxide paper discs, gave less favorable results.

Electricity Not a Form of Magnetism.

Professor Hughes has recently advanced views about magnetism which, if accepted, will largely modify the position which science assigns to this property. He asserts that where there is no apparent magnetism, or the magnetism is neutral, there is not, as had been supposed, an indifferent turning of the molecules in all directions, with consequent balancing of influence, but, on the contrary, there is a perfectly symmetrical arrangement, the molecules (or their polarities) arranging themselves so as to satisfy their mutual attraction by the shortest path, and thus form a complete closed circuit of attraction. When magnetism becomes evident, the molecules (or their polarities) have all rotated symmetrically in a given direction, but the symmetery of arrangement is such that the circles of attraction are not completed except through an external armature joining both poles. Again, he shows that we have permanent magnetism when the molecular rigidity retains the molecules (or their polarities) in a given direction, and transient magnetism whenever the molecules are comparatively free. Professor Hughes also shows that the inherent polarity or magnetism of each molecule is, like gravity, a constant quantity, which can neither be generated, nor augmented, nor diminished, nor destroyed. Neither can magnetism be changed to any other form of force or property of matter. It must be therefore dissociated from electricity, as certainly as gravitation must be dissociated from heat and light. Electricity may be generated by magnetism just as light and heat (as in the case of the sun) may be generated by gravitation; but electricity is not a form of magnetism, any more than heat or light is a form fo gravity.—*Contemporary Review.*

Telephonic.

[For the REVIEW.]

Nashville and its Telephone Exchange.

NASHVILLE, TENN., July 11, 1883.

Nashville, Tenn., is one of the most important cities of the South in many respects. It is located on the Cumberland River, a tributary of the Ohio; had a population of 43,461 at the last census, and is also one of the principal stations on the Louisville and Nashville Railroad, which is the main thoroughfare between Louisville and New Orleans. It is about one hundred and eighty miles south of Louisville.

Being the capital of the State, it has a State-house, with a high cupola, from which an extended view of the surrounding country may be seen.

The Telephone Exchange here is owned by the Cumberland Telephone and Telegraph Company, which also possesses the exchanges of Memphis, Tenn., and Evansville, Ind.

Notwithstanding the comparatively small population of Nashville, the number of subscribers foots up to the considerable number of 675, while the number of lines is 625. In addition to these, there are seven trunk lines, connecting twenty-three towns, with all of which the Nashvillian may converse if he so pleases. The longest line leading out of the central office is that to Bonaqua, fifty-one miles. As is now generally the case, it has already been found convenient to economize space and time, by substituting for the first half or quarter of a mile from the central office, aerial cables, instead of single wires. Here there are five fifty-line Phillips cables; one hundred-line cable, same manufacturer; and one fifty-wire Western electric cable.

Instead of a thousand-ton cupola on the top of the exchange building, all the wires and cables are led into the central office by means of a massive and strong staging, on a level with the operating-room floor, and supported from the sidewalk by stout poles. Heavy cross-arms are arranged all round this, and direct the wires into a window on the floor above, where they pass through the lightning arresters, and then down through the floor to the switchboards.

The telephone man from the East at once reflects, on seeing this structure, upon the impossibility of inducing city authorities in Boston, New York, or Philadelphia to allow the erection of such a concern, useful and ornamental though it be.

The duplicate switchboard of the Western Electric Company has, within the last few weeks, been introduced into this exchange, and has already met the favor of its purchasers. As many of your readers know, it consists of duplicate switchboards, to which all of the lines are led in turn, while but half of the annunciators are placed at each board. The object, of course, is to separate the annunciators into convenient groups for handling, while all the lines yet are within reach of every operator. To work this successfully, it then becomes necessary to provide each operator with devices for ascertaining whether the line wanted is already in use by some other operator. This is done by placing a cell of battery in the circuit of the head telephone of each operator; and before making the desired connection, the operator just touches the plug at the end of the telephone cord to the plug hole of the line required. If that line is already in use, a low click is heard in the telephone. If at liberty, no sound is heard.

The capacity of this board is 1,200, and each of the duplicate boards may be worked by three or four operators.

Forty connecting cords are used at each side, being equal to the inter-connection of eighty lines. Forty disconnecting drops are included in the circuit of each pair of drops.

The name duplicate board only applies as long as there are but two boards; when the repetition extends further, "multiple board" is, of course, a more characteristic name. The operation of this system goes on very smoothly and expeditiously, and the telephone gives great satisfaction in Nashville.

Great credit is due to the present management for its energy, zeal, and application, inasmuch as the list of subscribers systematically increases in length at the rate of two inches per month, while the efficiency of the service is pre-eminently maintained.

E. S. Babcock, Jr., is the President of the Cumberland Co., Paul J. Marrs the General Manager, and E. T. Baker, Jr., Secretary and Treasurer, and also manager of the Nashville exchange. PSGOASSH.

CHICAGO, July 23.—The decision of the Patent Office, awarding priority of invention of the telephone to Alexander Graham Bell, of Cambridge, created consternation among the Chicago stockholders of the inventions of Prof. Elisha Gray. The stockholders have no cause for alarm, however, as at the time of the consolidation of the two companies iron-clad contracts were signed perpetually protecting them.

"In what light do you view the decision of the Patent Office?" was asked of Prof. Gray to-day.

"The question is one which neither the Patent Office nor the courts can determine."

"What do you propose to do to establish your claim of priority?"

"At the proper time I shall present the facts to the public in the form of a statement, but the proper court in which to decide this matter should be composed of a jury of scientific men. No, sir, I am not willing to accept the decision of the Patent Office."

One of the great points claimed by a new system of electric lighting is that "its generator works without any sparking." Such a system may do for old folks and some people of peculiar ideas, but it will never become popular "without sparking." Why, pshaw, that will never do, it would ruin the trade in gate hinges.—*Artisan.*

The Denver Exposition building presents a live appearance. Exhibitors are busily engaged in arranging their displays. The fine art exhibit will be exceedingly fine. The Union and Pacific, Burlington, and Atlantic and Pacific Railroads are rearranging their displays, and providing for extensive additions. The Richmond and Danville road, operating in Virginia have been assigned a prominent space in which to show their cabinet of minerals, reputed to be the finest in the United States, to compete with the iron, coal, and precious metal collection from the Rocky Mountains. The commissioners of the Tertio Millennial Exposition, Santa Fe, promise their entire mineral collection at the close of their exhibition.

Telephone Work for Ladies.

Cassell's Magazine for the current month contains a letter addressed to the publishers from Miss Merlin, lady superintendent of the United Telephone Company, in which she states that one hundred ladies are now employed by that company, nine of the exchange offices being under their care. She speaks in high terms both of the employment itself and of the manner in which the ladies have discharged their duties.

All the New England Companies to be Consolidated.

BOSTON, Mass., July 18, 1883.

The consolidation of the New England telephone companies will probably be effected in this city to-morrow, when the directors of the American Bell, the Lowell syndicate, and of the several sub-companies will meet and consider a plan of union. The plan will involve a considerable increase in the present capital stock of the companies to bring them upon a common 6 per cent. dividend-paying basis, as several of them now pay dividends considerably in excess of that figure. The following, it is understood, embraces the principal features of the basis of union: The Boston and Northern Telephone Company, which comprises Essex County, Mass., and nearly the whole of New Hampshire and Vermont, now has a capital of $1,000,000, of which the American Bell owns $300,000. This will probably be put in at 20,000 shares or $2,000,000. It now pays 12 per cent. dividend.

The Bay State Company, which embraces the State of Massachusetts, with the exception of the cities of Boston, Lowell, Fitchburg, Worcester, Brockton, New Bedford, Fall River and Taunton, Essex County, and Cape Cod, now has $800,000 capital, of which the American Bell owns $240,000. This capital will doubtless be increased 50 per cent., to $1,200,000, as it now pays 9 per cent. dividend.

The National Bell Telephone Company of Maine now has a capital of $1,500,000, it having been recently increased by a 200 per cent. stock dividend from its original capital of $50,000, and now pays 5 per cent. dividend.

The Granite State Company of Manchester, N. H., with a capital of $130,000, will doubtless remain the same under the new arrangement. Its dividends heretofore have been 5 per cent.

The Suburban Telephone Company, embracing the cities and towns within a radius of 15 miles of Boston, now has $350,000 capital. This will probably be increased to $500,000, as it is now paying dividends at the rate of 9 per cent. and has paid 10.

The Southern Massachusetts, with a capital of $500,000, embraces the cities of New Bedford, Fall River, Brockton and Taunton, and the southeastern portion of the State. Its capital will probably be doubled and made $1,000,000.

The Telephone Dispatch Company, which covers the city of Boston, is owned entirely by the American Bell. It will probably be put at $2,000,000.

The Connecticut Telephone Company, which embraces also several towns outside of Providence, will probably go in at $500,000.

In addition to the companies mentioned there are several small companies and exchanges which will be put in at less amounts, making the aggregate capital of the consolidated company somewhere between $12,000,000 and $15,000,000.

We are informed that the Telephone Exchange Company, which has hitherto operated the telephone exchanges in Baltimore and other cities and towns in the State of Maryland, was, on July 12, consolidated with the National Capital Telephone Company of Washington, the two forming the Chesapeake and Potomac Telephone Company. The new company has a perpetual license from the American Bell Telephone Company of Boston upon favorable terms. Its capital is $2,650,000, of which the Baltimore company represents about two-thirds. The property consists of the business and exchanges of the State of Maryland and of the District of Columbia. It begins business with over six thousand telephones in use and a large area of undeveloped territory. For the development of this territory there is $100,000 cash in the treasury. The directors of the new company include Messrs. Wm. H. Forbes, president of the American Bell Telephone Company; A. G. Davis, president of the old Baltimore Company; A. B. Proal, of Baltimore; H. D. Cooke and H. S. Cummings, of the old Washington Company, and Morris F. Tyler and H. P. Frost, of New Haven, Ct., of the Southern New England Telephone Company. The officers are Messrs. Morris F. Tyler, president; A. G. Davis, vice-president; H. D. Cooke, treasurer, and Warren Choate, secretary. The new company takes immediate possession of the property and management. The Maryland Telephone Company was the first one organized in the State. It began with a capital of $50,000. There were but few subscribers when it started, and the receipts for the first month amounted to only $78. The company was in operation from 1879 to 1882, during which time its capital was increased to $200,000. In 1882 the name was changed to the Telephone Exchange Company, with a capital of $500,000.

The Brush Electric Light and Power Company, Nashville, Tenn., have placed in the rotunda of the Maxwell House one of their storage batteries. It is claimed by the company that it is the most remarkable invention of the age, as connected with the application of electrical force to lighting purposes. They assert that with its assistance they are able to store electricity in any house, which will enable the occupant at any time to turn on small lights, without reference as to whether the engine at the station is running or not.

Telephone Invention.

DECISION OF THE PATENT OFFICE EXAMINER—BELL'S PRIORITY—IN THE MAJORITY OF THE DETAILS HE IS DECLARED THE EARLIEST INVENTOR.

WASHINGTON, July 21, 1883.

The first stage of the settlement of the question of priority of invention of the several parts of the telephone was reached to-day, when the Examiner of interferences in the Patent Office promulgated his decision in "the speaking telephone interference cases." The first of these interferences, of which there are eleven, was declared in March, 1878, and the Patent Office has at various times since then considered them and heard arguments upon them. The parties originally involved were A. G. Bell, J. W. McDonough, T. A. Edison, E Berliner, G. B. Richmond, E. Gray, A. E. Dolbear, A. G. Holcombe, C. E. Chinnock, C. A. Randall, F. Blake, J. H. Irwin and G. M. Phelps. W. L. Voelker was made a party to three of the cases in 1879.

Of the original parties, decisions have heretofore been rendered against Richmond, Holcombe, Randall, Phelps, Chinnock and Berliner. The decision of the remaining eleven cases covers 348 printed pages. The several interferences are denominated respectively as interferences A, B, C, D, E, F, G, I, J, L and No. 1.

INTERFERENCE A.

The subject matter of interference A is defined as "the art of transmitting and reproducing at a distance sonorous waves or vibrations of any description, which consist in increasing and decreasing the strength of an electric current traversing a circuit in such a manner as to produce in said circuit a series of electrical waves or vibrations precisely corresponding in their intervals of relative amplitude to the sonorous waves which are to be reproduced at the receiving station or stations, so that oral conversations or sounds of any description can be telegraphically transmitted." With regard to this interference the examiner holds that the evidence shows that this art "had not been invented prior to the filing of Bell's application for a patent, February 14, 1876." Priority of invention is accordingly awarded to Bell on this count. The parties to this interference were Bell, Gray, Edison and Voelker.

INTERFERENCE B.

The subject matter of interference B is defined as "the improvement in the art of transmitting vocal sounds or spoken words telegraphically, which consists in throwing upon the line, through the medium of a varying resistance, electric impulses corresponding to the vibrations of a diaphragm operated by the movements of the air produced by a spoken word." The parties to this were Bell, Gray, Edison and Voelker. The examiner holds that while "Gray was undoubtedly the first to conceive of and disclose the invention, as in his caveat of February 14, 1876, his failure to take any action amounting to completion until after others had demonstrated the utility of the invention, deprives him of the right to have it considered as a continuous act. "He holds that it is not proved that Edison possessed a knowledge of the art or method prior to June 25, 1876, when Bell had reduced it to practice. Priority of invention in this insrance is accordingly awarded to Bell.

INTERFERENCE C.

Two inventions included in interference C are thus defined: "First, the transmitter, consisting of the combination in an electric circuit of a diaphragm and a liquid or equivalent substance of high resistance, whereby

the vibrations of the diaphragm cause variations in the resistance of the electric circuit and consequently of the strength of the current traversing said circuit. Second, in a telegraph instrument operated by sound, the combination with the diaphragm of two or more electrodes placed in an electrolytic liquid, and operating to increase and decrease the resistance of the electric circuit by the movement derived from the diaphragm." In these inventions the examiner awards priority of invention to Bell.

INTERFERENCE D.

The subject matter of interference D is in "an electro hydro-telephone, the fluid holding vertically an adjustable tube, within which the ends of the platinum points are immersed." The examiner awards priority of invention to Edison on the ground that in Edison's "exhibit water telephone," proved to have been made as early as December, 1876, the first embodiment of this feature is shown.

INTERFERENCE E.

The invention embraced in interference E is defined as an acoustic telegraph, "including sound producers as well as reproducers on armature plate (consisting of a diaphragm of iron or steel, an armature fastened to a membrane diaphragm or a non-musical armature plate fastened at one end), the electro-magnet for the same and a closed circuit passing from the helix of such electro-magnet to the source of undulatory electric energy." The parties presenting claims were Bell, Edison, Dolbear and Gray. The examiner awards priority of invention to Bell, fixing the date of his patent as February 14, 1876.

INTERFERENCE F.

The subject matter of interference F is defined as follows: "First, a telephonic transmitter, consisting of a coil of wire, one or more magnets, and a disk or diaphragm so arranged relative to each other that a motion of the diaphragm shall induce in the coil of wire an electric motive force in virtue of the presence of the magnet or magnets; second, the combination in one circuit of two or more disks or diaphragms so arranged relatively to each other that if one of the disks or diaphragms be put in motion by the voice, by a current of air or otherwise it shall induce a transient current of electricity in its associated coil, which current shall actuate the other disks or diaphragms in virtue of the coil and magnets associated with them. The examiner holds that Gray and Dolbear are not shown to have invented the subject matter prior to February 14, 1876, the date of Bell's patent, and awards priority of invention to the latter.

INTERFERENCE G.

The invention embraced in interference G is defined as "a telephonic receiver, consisting of the combination in an electric circuit of a magnet and a diaphragm supported and arranged in close proximity thereto, whereby sounds thrown upon the line may be reproduced accurately as to pitch and quality."

The parties to this interference were Bell, Edison, McDonough, Gray and Dolbear. May, 1875, is fixed as the date of McDonough's invention, and priority of invention is awarded to him.

INTERFERENCE I.

The declaration of interference I embraces a "telephone transmitter consisting of one or more helices forming a portion of the main circuit and surrounding a core or cores maintained in a magnetic state by the inductive influence either of an electric current or of a permanent magnet in combination with an elastic inductive plate or armature which is rigidly supported at one or more of its edges, while the portion facing the poles of the magnetic core or cores is left free, so as to be capable of responding to sonorous vibrations traversing the atmosphere or other bodies." Priority is awarded to Bell.

INTERFERENCE J.

Interference J includes the "combination with an electro-magnet of an iron or steel diaphragm secured to a resonant case for rendering audible acoustic vibrations. Priority is awarded Bell.

INTERFERENCE L.

The subject matter of interferenee L is declared as follows:—"First—The combination is an acoustic telegraph of an electro-magnet and a polarized armature formed of a plate of iron, steel or other material capable of inductive action and a resonant tube or case Second—The combination is an acoustic telegraph of an armature plate polrarized by induction, a resonant case or tube, and an electro-magnet and circuit connections whereby reversed currents are caused to act in the electro-magnet with varying intensity proportionate to the electric waves sent from the transmitting station." The contestants were Gray, Bell and Edison. Priority is awarded Bell.

INTERFERENCE NO. 1.

The subject matter of interference No. 1 is described as follows: "A spring forming or carrying one electrode and constantly pressing against the other electrode and the diaphragm to maintain the required initial pressure between the electrode and yield to the movements of the diaphragm." The contestants were Voelker, Blake, Irwin and Edison. Priority of invention is awarded Edison.

That Mexico will eventually succumb to electricity the following incident will anticipate. Writing a gushing letter for a very-much-in-love-young-man, a professional letter-writer makes use of the following bit of intense sentimentality:

"The inexpressible desire of meeting thee and to thee alone unburden my bosom of its surcharged load of electric love grows greater daily." We rise to remark: Dry up, you old bald-headed imbecilic secondary battery, dry up! Is it possible that the law permits you to disseminate a current of this intensity?

The young man has our sympathy and our hopes that he will procure a storage battery and charge in some of the surplus "load." It will be handy to have around the house after the first stages are past and the honey-moon over.

The Central District and Printing Telegraph (telephone) Company of Pittsburgh last week elected the following directors: D. Leet Wilson, Ralph Bagaley, Geo. I. Whitney, John L. George, C. O. Rowe, Jas Merrihew, Theo. N. Vail, Geo. L. Phillips, Charles R. Truex.

The stockholders of the Mexican company, of whom there are 835, will shortly receive a circular saying:

"Notice is hereby given that it is the intention of the Mexican Telephone Company to increase the capital of said company to the sum of $2,000,000, and that a special meeting of the stockholders will be held at its office, 5 Beekman street, N. Y., on Tuesday, August 14, 1883, at 12 o'clock noon, to provide for such increase and to take such action in the premises as may be necessary or expedient. F. E. C. BRYANT,
Secretary."

Accompanying the above is a blank form of agreement to be signed and returned with a proxy in case the stockholder is unable to attend in person the meeting.

"It is very important," the officers say in another circular to be forwarded with the foregoing, "that you should sign the agreement and proxy at once, and send them to the Secretary if you yourself cannot be present It is necessary to receive the assent of the holders of $750,000 of the stock, and a failure so to do we consider might be vital to the interests of the company."

The new stock cannot be issued under the laws of New York, in which State the company was incorporated, unless three-fourths of the stock assents. While the "intention" provides for doubling the capital, the present purpose is to issue no more than the 25,000 shares subscribed for by a syndicate. If, later, the extension of the works should require additional funds, more stock could be issued without going through the formality of obtaining the further assent of the stockholders.

Venezuela Telegraph Lines.

BOGOTA, July 18, 1883.

Notice has been given that the Government telegraph lines of Venezuela were opened yesterday to the frontier of Colombia, where they connect with the land lines of this Government, which are in direct connection with the lines of the Central and South American Telegraph Company, via Galveston.

Russian Female Telegraphists.

An Odessa correspondent writes as follows: "According to the semi-official *Journal de St. Petersbourg* the question of the right of female telegraphists to the receipt of pensions has at last been favorably and definitely settled, thanks to the energetic efforts of Major-General Bezak, Director of the Department of Russian Telegraphs. The statute fixing these pensions has just been approved. The right of pension will be acquired after twenty years' service. After twenty-five years the télégraphistes may retire on full pay. Marriage will entail no limitation of pension, but on the contrary the pension passes to the children."

New Time Telegraph Company.

NASHVILLE, Tenn., July 14.—The Southern Time Telegraph Company was chartered here to-day. It is authorized to operate in Virginia and West Virginia, Tennessee, Georgia, North and South Carolina, Florida, Alabama, Mississippi, and Kentucky.

Speaking of Th. du Moncel's new work, *L'Electricite comme Force Motrice*, the EVENING POST says:

Many believe that the great future of electricity is in the direction of the transmission of power rather than in that of illumination. Companies are already formed in this country and in Europe to propel street-cars by electricity, and to utilize this form of energy in driving small motors. One engaged in the study of electricity could have predicted with great certainty that Count du Moncel would publish a treatise on this subject. His pen is very prolific, and he is the modern type in science of the ancient flying messenger anxious to be the first to announce wonderful results to the world. On the whole, we are pleased with this treatise. It is true that the method followed is that of Knickerbocker's "History of New York." Du Moncel begins very nearly with the creation of the world of dynamo machines, and proceeds by easy gradients to the wonderful present.

"Alors qu'on ne développait à grand'peine, par les moyens électriques que quelques kilogrammètres de force, aujourd'hui on fait travailler des charrues, des pompes à jets énormes, des grues, des scieries mécaniques, des machines à raboter, à percer, à forer, des tramways meme ! ! !"

The exclamation-points are Du Moncel's, and who will complain of superabundance when the richness of the subject and the enthusiasm of the author are considered?

Du Moncel gives, on the whole, enlightened criticisms of the various dynamo machines which have met his eye in the late expositions in Europe. He describes the small motors of Trouve and of Desprez, and the various experiments with them, better than any previous writer has done. We find no reference to the application of storage-batteries to the transmission of power, and the electrical tricycle must apparently have a place in a new treatise.

An extraordinary phenomenon due to lightning took place at some yards from the powder-mill at Annecy (*Haute-Savoie*), during one of the late great storms. At the end of a dazzling flash of lightning, two balls as large as eggs, of a pale light, descended to within about one yard from the ground and then began to oscillate, as though they were alternately attracted and repelled by some invisible power. Suddenly a flash of lightning glittered, the two balls burst simultaneously, and a formidable detonation was heard all over the city of Annecy. Eight persons witnessed this strange spectacle. At the moment of the explosion, two among them felt a violent pain in the chest, four were thrown down, and the remainder felt nothing. As to the fluid, it left no trace of its passage.

Cables.

The *Journal Telegraphique* for May 25 gives a table of the existing cables, the date when the cables were laid, their length, the number of wires per cable, the total length of wire, and the nature of the service for which the cables are used.

I.—*Cables belonging to various Governments.*

		Naut. miles of cable wire.	Naut. miles of wire.	No. of cables.
Germany	has	436.19	1042.24	32
Austria	"	97.49	103.97	29
Denmark	"	111.63	410.18	32
Spain	"	129.10	129.10	3
France	"	2329.273	2345 273	41
Great Britain	"	576.194	1528.163	92
Greece	"	104.60	104.60	13
Italy	"	250 29	262.00	15
Norway	"	245.76	245.76	224
Belgium	"	40.70	61.81	14
Russia	"	201.80	209 84	5
Sweden	"	58.60	58.60	7
Turkey	"	330.66	333.66	12
Indo-European	"	1707.00	1707.00	5
India	"	36.35	36.35	2
Japan	"	55.498	103.368	11
Russia (Asiatic)	"	70.017	70.017	1
Australia	"	43 50	43.50	2
New Caledonia	"	1.00	1.00	1
India (Dutch)	"	54.91	54.91	1
New Zealand	"	196.315	284.940	3
Canada	"	200.00	200.00	1
Totals		7276.927	9336.281	546

II.—*Cables belonging to Private Companies.*

Company.	Naut. Miles.	Naut. Miles.	No. of Cables.
Submarine Telegraph Company.	803.69	3728.64	10
Vereinigte Deutsche Telegraphen-Gesellschaft	1119	1794	2
Hamburg-Helgolander Telegraphen-Gesellschaft	32	32	1
Direct Spanish Telegraph Company	699.13	699.13	2
Mediterranean Extension Telegraph Company.	198	198	3
Black Sea Telegraph Company.	350	350	1
Indo-European Telegraph Company	8	24	1
Great Northern Telegraph Company	5916	6142	17
Eastern Telegraph Company.	16814.85	16859.85	49
Eastern and South African Telegraph Company	3858	3858	4
Eastern Extension, Australasia and China Telegraph Company.	11265	11265	15
Anglo-American Telegraph Co.	10437.56	11035.70	15
Direct United States Cable Company.	2983	2983	2
Compagnie Française du Telegraph de Paris à New York	3409.34	3409.34	4
Western Union Telegraph Company	5567	5537	4
Brazilian Submarine Telegraph Company.	4296	4296	4
Cuba Submarine Telegraph Co.	940	940	3
West India and Panama Telegraph Company.	4119	4119	20
Western and Brazilian Telegraph Company.	3801	3801	9
River Plate Telegraph Company.	32	64	1
Mexican Telegraph Company.	709	709	2
Central and South American Telegraph Company.	3178.11	3178.11	9
West Coast of America Telegraph Company.	1698.72	1698.72	7
Totals	82214.40	86721.49	135

GRAND TOTAL.

1 Belonging to Governments	7276.927	9386.281	546
2 Belonging to Private Companies.	82214.40	86721.49	135
	89491.327	96057.771	731

Electrical Review,

FORMERLY REVIEW OF THE

Telegraph and Telephone.

Published Weekly at 23 Park Row.

P. O. BOX 3329.

GEO. WORTHINGTON, Editor. THOS. H. DELANO, Publisher.

SUBSCRIPTION.

United States and Canada, $3.00 per annum, in advance.

Great Britain and other foreign countries, $4.00, in advance. Postage free.

ADVERTISING.

Transient rate, 25c. per line each insertion.

"Business specials," 35c. a line.

EDITORIAL ANNOUNCEMENT.

Address all communications and make all checks and P. O. orders payable to order of Delano and Company, Proprietors. P. O. Box 3329, New York.

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We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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From whom copies of the paper can be procured.

The Montreal News Company, Montreal, Canada.
The Toronto News Company, Toronto, Ontario, Canada.
Wm. Dawson & Sons, London, England.
H A. Kramers & Son, Rotterdam, Holland.
Berthold Mendel, Berlin, Germany.
F. D. Osborne, Calcutta, East India.
F. Knauff, Moscow, Russia.
Otto Maass, Vienna, Austria.

NEW YORK, JULY 26, 1883.

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The differences now existing between the Western Union Telegraph Company and its employes will, if not equitably adjusted at an early day, perhaps lead to serious consequences.

It is to be hoped that the Company's Directors may not be inclined to look upon the present situation as one in which they and those whom they employ are alone interested. This is by no means the case, and we shall be greatly disappointed in our estimate of their judgment should they, while coming to a decision in the present case, overlook the interests of the third and most important party to the controversy, viz., the public.

There is, of course, much to be said on both sides of the question at issue; much to be said in support of the demands, or some of them, which have been made by the intelligent, hardworking, painstaking employes, and not a little to be said for the company that gives them employment, and which, it is but just to say, has usually dealt fairly with them.

A man or a woman performing the same work with the same expedition and accuracy should be paid precisely alike, and whether the Western Union or any other Company recognizes this or not, the time is not far distant when the general diffusion of intelligence and the spread of reason will compel it to do so.

Again, though the incumbent of a small office, usually having other employment for which he receives wages, may be paid a trifling sum; the expert in the important office, ever busy in the company's interest, should be paid living wages—wages equal to those received in other employments which call for the same display of skill and intelligence. The Company's best interests require it.

On the part of the Company it must be confessed that the arguments of the petitioners are not altogether logical nor their demands reasonable.

It is but just that expert operators should be properly compensated, but that an equal rate should be given their fellows who lack experience or skill, is more than they have a reasonable right to demand and more than the Company is likely to grant.

Our contemporary *The Tribune* says: If the Brotherhood of Telegraph Operators had complied with the requirements of their own constitution it is probable that the present strike would have been averted. One of the provisions of that document is that "no strike can be instituted until after all attempts at arbitration have failed." If the telegraph operators have substantial grievances, there is no doubt that a fair presentation of their case would meet with considerate treatment by the managers of the various telegraph companies. But the course pursued by the operators has been reckless and unwise, and in direct antagonism to the constitution of their association. Instead of making an attempt at arbitration, they practically closed the door against it.

Nothing has been heard of the strikers' grievances until within a few days. No general complaint had been made, or petitions for redress sent to the officers of the telegraph companies; at least so far as the public has been informed. But suddenly a committee of strangers, representing a secret association, waits upon the telegraph officials and makes a demand the practical effect of which would be to increase the pay of all employes from 70 to 90 per cent. It is estimated that it would cost the Western Union Company alone $1,500,000 annually. The telegraph companies failing to comply with the demand in forty-eight hours a general strike is ordered.

Was that an attempt at arbitration? No intelligent operator will assert that it was. No course was left open to the telegraph companies but to refuse to accede to extravagant demands. If a committee of strangers, representing an oath-bound secret society, can suddenly walk into the office of a telegraph or other company, and make such unreasonable demands and enforce compliance therewith, without allowing time for investigation or to arrange the business of the company to meet the new burdens imposed upon it, then there will have to be an entire change in the methods of transacting business. The telegraph companies could not afford, in the public interest, to grant the demands of the Brotherhood of Telegraph Operators, even if there were more justice in them than appears to be the case. No doubt some of the concessions asked by the men, such as extra pay for Sunday work, would have been granted by the telegraph companies if properly laid out before them. But, as a whole, the demand of the operators was unreasonable, and was especially objectionable in the way that it was presented. There is nothing in the condition of business to warrant such a large advance in wages, and the strikers will undoubtedly soon be convinced of the fact.

In the meantime, public business suffers slight inconvenience, but that will not long continue. Strikes are a poor way of settling labor disputes, and without public sympathy rarely succeed. In the present case the telegraph operators have made a foolish mistake which they will no doubt long regret

The Beginning of the End

The indications already point to a failure of the great telegraphers' strike. A variety of causes, not easily foreseen, have conspired against the Telegraphers' Brotherhood.

First, the ill-advised action of their committee, in precipitating the strike without, even for a day or two, waiting till the action of the grievance committee of the Western Union could be ascertained, has largely alienated the powerful support which might otherwise have been found for the movement in public sympathy and interest. In contemplating so reckless an action, where the delicacy of the interests involved is considered, the conservative public will naturally feel more of alarm than sympathy, and this, with the natural result of losing sight of whatever merits the case and claims of the telegraphers may have.

Again, it required to assure success, that the rush of outgoing employes should be potent enough to make a clean sweep, or at least enough to greatly perturb, if not wholly disconcert the current business of the lines. This, not only to give éclât to the movement and confidence to the wavering, but as well to create that great public inconvenienc which would react in a pressure upon the employers.

But no such decided result of the kind appears; the companies apparently keep up to and dispatch their ordinary business without flagrant delay, and find in the greatly decreased volume of business which offers, no more than their remaining or hastily secured force of operators can in one way or another dispose of.

That the companies are helped by a decrease in the public business is a natural result of the arguments made by the strikers themselves, for, of course, anyone otherwise using the telegraph freely, will stop and think before he entrusts a business message, with its involved risk, to the mischances which the latter predict and have made possible.

Nor does the existing state of things work any unendurable hardship to the community, since no serious or definable loss which can be brought home to any individual accrues from the temporary cessation of telegraphing on purely speculative business; and, as has been pointed out by representatives of the leading trades, where all are alike relegated to the mails, and no one individual secures a preference over the other, but little suffering accrues.

In a strike of employes of railroads there is more chance of securing that embarrassment to the employers, which is a necessary element of success.

Goods which are refused for shipment block the stations, and any delay in their forwarding rapidly grows into a public inconvenience of the most serious character. There is no substitute for the railroad to avail of, but with the telegraph, the mails are always at hand ready to take off immediate pressure and afford protection, at least against a total failure of communication.

All these things being considered it is not difficult to hazard the prediction that the operators will soon again be at their desks, and the telegraph business of the country restored to its normal conditions. However useless it may then be to regret the unnecessary expense and waste involved to all parties by the strike, it should not be forgotten to accord the fullest sympathy to those of the unfortunate operators who have been misled into the doubts, difficulties and hardships of a strike, by designing men engaged in promoting their own selfish ends.

Scientific Charity.

During the last decade, while electrical science attracted almost universal attention and electrical discoveries followed so fast as almost to tread upon each other's heels, it never occurred to the staid old gentlemen who control the destinies of Columbia College to establish a chair of applied electricity. The young men were instructed as their fathers and grandfathers had been before them and doubtless found the subject just as uninteresting and tedious. They have had it explained to them that amber, when rubbed, has the property of attracting light bodies Then came atmospheric electricity, with particular reference to the experiments of Franklin, following which came what might not inappropriately be called the glass tube "trick," which consists in making a glass tube attract light objects by rubbing its outer surface with a silk handkerchief. The light body attracted, after remaining in contact with the glass for a few seconds, is seen to be shaken off, attracted no longer, and finally repelled. Then the light body is touched with the finger, and is placed thereby in a condition to be immediately attracted by the glass tube. A stick of resin or sealing-wax is then rubbed with dry flannel, and is then found to produce the same result as the glass tube.

All this and much more of the same sort was yearly gone over, but, with the exception of the occasional showing of a telephone and short dissertations upon electric lighting, little of real practical value was done in electrical science.

At a recent meeting, however, the Board of Trustees, having now ruminated upon the subject for some years, suddenly came to the conclusion that electricity is destined to play a very important part in the world of the future.

Whether the old gentlemen composing it really found this out for themselves, or whether they were, so to speak, put up to it by some less learned outsider, we have not been informed. When we heard that they had decided to establish a chair of electricity, though it came somewhat late in the day, we congratulated them upon their wisdom, and also the undergraduates, who would be sure to profit by it.

But it seems, however, that the public and not the college is expected to pay for this seeming generosity on the part of the trustees. In other words, the need of such a department is made use of to obtain further endowments for the college. Were this a free, unendowed college, engaged in educating poor young men without money and without price, there might perhaps be some excuse for thus passing around the hat But this is by no means the case. Columbia is probably the most richly endowed college in the country, having millions at its back, and all those who matriculate are pledged to pay a good round sum into its coffers yearly.

But perhaps the most absurd proposition set forth in the circular which has been sent by the faculty to the various telephone and electric light companies, is that they are to be benefited by the establishment of an electrical course. The experience had in the various machine shops—without going further—will serve to show the fallacy of this reasoning. With few exceptions, the work here is done by practical men, who have worked their way up from the bench. College-bred men play only a small part.

The establishment of an electrical chair in

Columbia, and a department filled with the newest and most perfect electrical appliances, will so benefit its students that, upon graduation, they will be enabled the more readily to learn the practical part of electrical construction. That is all. Theoretical knowledge is always valuable. Combined with practical knowledge, it renders its possessor almost invaluable in the workshop.

But why should the electrical companies pay thousands of dollars to Columbia College upon the promise of its trustees to give young men a theoretical knowledge of electrical science? Why should not the college be asked, upon the same theory of benefit, to pay the electrical companies a good round sum for furnishing its graduates from the electrical department with positions, in which they may, with industry, earn a livelihood?

The best advice we could give the trustees of Columbia College is to cease asking alms, and, if the nature of their princely endowments will not permit the use of any part thereof toward a chair of applied electricity, to postpone its establishment until they have the means themselves.

One often hears the expression concerning some recent invention, "What an ingenious arrangement!" followed by the question, "How could the inventor have thought of this?" and the query is sometimes put with a mental acknowledgment that the brain of the questioner must be lacking, in that he had never invented anything that was original—always quick enough, perhaps, to see the necessity of such and such an invention when it has been wrought out, but never quick enough to be himself the inventor.

Now, while it will be admitted that some minds are quicker to act than others, and some people are naturally gifted with inventive genius, it yet remains to be said that in a great many cases the true cause of the lack of inventive powers displayed by some admittedly clever people is not so much owing to any dearth of brain power below that of those men who have succeeded in inventing some remarkable thing, as that the workings of the mind of the former have not been directed long enough in the course necessary to such a result.

It is not remarkable, for instance, that a person whose mind has been occupied by the transactions incidental to the successful running of a grist mill should not have invented an electro-dynamo machine, nor that another person, who has been busily engaged in perfecting an electric lighting system, should not have devised a new and improved method of removing the rust from wheat? Nor is it any the less remarkable that the person who, from day to day and year to year, mechanically pursues the even tenor of his way in that particular line of business in which he may be employed, without regard to the natural laws that govern the operation of the machinery under his control, should not be that person who surprises the world with some important improvement in that machinery.

Again, many people lull their minds to inactivity by an insufficiency of self-conceit. They say to themselves, "There is no use in my endeavoring to do such and so; my mind is not so constituted." This is a mistake. There never yet was a healthy mind that was not capable of improvement, no more than that there does not exist a healthy body which is not capable of physical development by the use of proper means. Men should remember that what man has done man can do.

Another thing that prematurely discourages some from striving to invent is, that on looking around everything seems to be developed to its utmost. This was doubtless the same conclusion at which many arrived long before the present improvements were devised; but there were some minds that thought differently, with the result that is before us.

Is it not, then, at least as likely that succeeding generations will note as great an improvement over the things of to-day as we do over those of the past?

If such is to be the case it is evident that the brains of to-day must be at work on that object, and if so, why not ours?

What, then, is necessary to aid in the development of a capacity for invention?

Well, the books which aim to give advice on this point all agree that to invent anything one must always be prospecting for improvements, on the alert for suggestions, hints, &c., which is very good advice so far as it goes; but is it probable, for example, that the man who having charge of an electro-dynamo machine, by simply looking about him can devise an arrangement to save the machine from burning in case of the short circuiting of its coils? Not reasonably. He must at least know what metals are more fusible than the material composing the coils of the armature, or he must know the effect of an increased strength of current on a magnet, &c., according to the manner in which he proposes to accomplish this purpose.

Who will be the more likely to invent an improvement on the hydraulic machine? The unaspiring engineer who operates the lever or the hydraulic engineer thoroughly conversant with all the laws of hydraulics. The answer goes without saying.

Thus, it is evident that if one would develop a capacity for invention he must not only be on the *qui vive* for ideas, but he must also inform himself concerning the natural laws bearing on the subject under his consideration.

He should also read the history of the development of the science with which he is identified, from which he will, in all probability, derive many useful hints. On one occasion we heard an inventor tacitly admit that he obtained what was perhaps the main idea of a successful sextuplex system of telegraphy from the description of a long abandoned duplex telegraph.

In addition to this an acquaintance with the history of a science may prevent the loss of much time in inventing something already long invented.

The text-books on the subject should also be carefully read. From these much useful information may often be cheaply gleaned. Thus, if in one of these books it is stated, as it is, that by preparing glass in a certain way copper may be electrically deposited thereon, the wide-awake operative in an electro-metallurgic establishment should be led to inquire to what useful purpose this knowledge can be made applicable, or perhaps he may find even a better preparation for the purpose. It is only recently that we were shown specimens of stained glass joined together by an electrolytic deposit of copper, which makes a much neater and probably firmer joint than the old method of lead jointing.

Another means of getting valuable information is by attending the lectures given by professors of the various sciences, especially when actual experiments are to be made, and to those interested in the electrical science, the lectures delivered of late before the New York Electrical Society have been redundant in this respect. Indeed, if some of the lecturers had understood that they were addressing a body of such people as those for whom these remarks are intended, their advice and information could not have been more explicit or directive. For example, a professor of electro-metallurgy in a recent lecture, after describing the solution he had used for the purpose of electro-tin-plating lead bullets, stated that his solution gave too chrystalline a deposit, and consequently was not an entire success, and advised his hearers to endeavor to discover a more satisfactory solution for this purpose, as there was a ready market and pecuniary reward in store for the discoverer of such a solution.

However, it may be said by way of caution, that the theories laid down in books or expounded by professors and others should not be too implicitly followed, for many theories that have been so laid down and expounded as immutable, have proved to be delusive.

Take, for instance, a theory that was once considered unassailable with regard to the quadruplex system of telegraphy. It was stated that a continuity preserving pole changer on this system was absolutely necessary, the reason given for this statement being, that if the circuit should be broken for the shortest instant, the signals would thereby be broken up, and to those who understood the system the theory seemed quite plausible, consequently it was stated that dynamo currents of considerable strength could not be used on this system as they would burn out the contact points of the pole changes.

But an inventor, interested in making the dynamo currents available on all circuits, experimented with a non-continuity preserving pole changer, namely one that allowed a small but decided break in the circuit, and thus prevented the short circuiting of the currents, and lo! it worked successfully in spite of the theory to the contrary.

Of course, we have been discussing this whole matter in its relation to interests and improvements of universal benefit. The person who devised the toy ball with elastic attachment made a fortune in a very short time, but such devices partake more of the nature of discoveries or accidents than invention, and they are to a certain extent limited, while the fields of invention in the domains of science are comparatively untrodden.

Especially is this true of the science of electricity, notwithstanding that every day brings forth inventions and improvements in the electric light, the telegraphic, the telephonic, metallurgic and other branches of this science, and who are the inventors? In nine cases out of ten we venture to predict they are the self-educated workmen in these various departments, and it is safe to assume that the majority of these inventers at one time of their career had as many misgivings as to their ability to invent anything as the most unsanguine of those to whom we refer in our opening remarks.

Indeed, the fact that more than one successful inventor have informed the writer that such is true in regard to their own cases in the early stage of their experiences has been the main incentive to the writing of this article that others might profit by this knowledge.

On the other hand, we are aware that there are some young men, and for that matter old men, too, who conceive the idea that inventing is their forte, and becoming engrossed with this notion fritter away time and money on wild-goose chases. Not counting the bore they become to their acquaintances and others whose valuable time the "would-be inventor" occupies with descriptions of his various systems of this and that. But this class forms, it is to be hoped, a very small portion of the community, and is composed of those who are actually deficient in brains, or those who are dabbling in matters, the simplest laws of which they probably could not explain. Of the latter kind a fair specimen was that party who after having patented an underground wire conduit, was surprised to learn there was such a thing as induction. The existence of such a class goes to prove what we have been endeavoring to establish, namely, that to become a successful and useful inventor one must become familiar with the subject under his consideration in all its bearings. In fact, just such a knowledge would doubtless dispense entirely with the class last mentioned.

The following amusing paragraph is going the round of the papers. We should be glad to have some information about these "recent discoveries."

"Recent discoveries in electrical science tell us that the flow of the electric current in the northern hemisphere is more rapidly northward during the night than at other times. If this be so, considering the high electrical condition often experienced by a great many, sleeping with the head due north (or a point west of north), in the flow of this current, would seem likely to be more conducive to perfect rest."

Sixteen thousand models of unpatentable inventions were recently sold at the Patent Office for $762. Think for a moment of the years of patient work, of the expenditure of mechanical skill, represented in these 16,000 models How many hopes were bound up in them! How many inventors went to their graves with their fond desires unrealized!

Electrical Notes.

The number of men roaming about unrestrained, in the full conviction that they are scientists, has increased greatly during the past few years, and something should really be done to induce them to return to their proper vocations, or else remain where they can only annoy their own families.

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I have not said, nor do I wish to infer, that these men are frauds or knaves—by no means.

***

They often possess fair attainments, though these are usually of a nature rather more pastoral than scientific.

***

Many a man now engaged in boring his friends and the editors of scientific journals, about subjects which he does not understand, might have been a successful farmer or an efficient clam-dredger on the picturesque shores of Long Island.

***

But though farming is accounted the most honorable occupation in which man may engage, and clamming a vocation in which the best blood of the country has from time to time taken an active interest, the alleged scientist is accustomed to look upon these and kindred pursuits with something akin to contempt.

***

He is a close, though by no means accurate observer of natural phenomena, and he talks of Herschel, Kepler, Newton, Meton, Euctemon, Hipparchus, Copernicus, and D'Alembert as though they were intimate friends of his, and of Monge, Ampère, Galileo, Arage and Davy as if they were his near neighbors.

***

His tree is continually blossoming with innutricious fruit, which, like the fabled apples of the Dead Sea, though fair to the eye, are a sad disappointment within.

***

After an extensive and tedious introduction, he will tell you that he has discovered how a certain thing can be done at less cost and more efficiently than at present; and when you ask for particulars, you find that he has in some curious manner hit upon some principle that was discovered in the days of his great-grandfather, and found to be inapplicable to the mechanism in question.

***

But don't try to explain this to him, because he wont understand you, and will detain you far longer with his explanations than if you direct him to some one particularly interested in the subject.

***

Quite frequently, when one of these would-be scientists makes a discovery, which he believes to be important—for they disdain to read up on the subjects they are interested in—he will write a full description of it and bring it personally to a scientific journal for publication.

***

There are three ways of disposing of the matter.

***

The first is to tell him bluntly that you can't print it; the second to wait until he is gone and then drop it into the waste-paper basket, and thus get it out of your way; and the third is to keep it carefully for the return of its author.

***

Dickens, than whom no man knew human nature better, admirably pictured this description of the scientist.

***

"That 'ere blessed lantern 'ull be the death on us all," exclaimed Sam, peevishly. "Take care wot you're a doin' on, sir; you're a sendin' a blaze o' light right into the back parlor winder."

***

"Dear me!" said Mr. Pickwick, turning hastily aside, "I didn't mean to do that."

"Now it's in the next house, sir," remonstrated Sam.

"Bless my heart!" exclaimed Mr. Pickwick, turning round again.

"Now it's in the stable, and they'll think the place is afire," said Sam. "Shut it up, sir, can't you?"

***

"It's the most extraordinary lantern I ever met with in all my life!" exclaimed Mr. Pickwick, greatly bewildered by the effects he had so unintentionally produced. "I never saw such a powerful reflector."

***

"It'll be vun too powerful for us, if you keep blazin' away in that manner, sir," replied Sam, as Mr. Pickwick, after various unsuccessful efforts, managed to close the slide

***

While these things were going on in the open air, an elderly gentleman of scientific attainments was seated in his library, two or three houses off, writing a philosophical treatise, and ever and anon moistening his clay and his labors with a glass of claret from a venerable-looking bottle that stood by his side.

***

In the agonies of composition the elderly gentleman looked sometimes at the carpet, sometimes at the ceiling, and sometimes at the wall; and when neither carpet, ceiling, nor wall afforded the requisite degree of inspiration, he looked out of the window.

***

In one of these pauses of invention the scientific gentleman was gazing abstractedly on the thick darkness outside, when he was very much surprised by observing a most brilliant light glide through the air at a short distance above the ground, and almost instantaneously vanish.

***

After a short time the phenomenon was repeated, not once or twice, but several times. At last the scientific gentleman, laying down his pen, began to consider to what natural causes these appearances were to be assigned.

***

They were not meteors, they were too low. They were not glow-worms, they were too high. They were not will-o'-the-wisps, they were not fire-flies, they were not fireworks. What could they be?

***

Some extraordinary and wonderful phenomenon of nature, which no philosopher had ever seen before; something which it had been reserved for him alone to discover, and which he should immortalize his name by chronicling for the benefit of posterity.

***

Full of this idea, the scientific gentleman seized his pen again and committed to paper sundry notes of these unparalleled appearances, with the date, day, hour, minute, and precise second at which they were visible; all of which were to form the data of a voluminous treatise of great research and deep learning, which should astonish all the atmospherical sages that ever drew breath in any part of the civilized globe.

***

He threw himself back in his easy-chair wrapped in contemplations of his future greatness.

***

If the alleged scientist of Dickens' day was not very different from him of our own day, it is not difficult to finish Dickens' picture.

***

It is safe to say the scientific gentleman wrote out his observations *in extenso*, and then took them around to his friends and to the scientific journals.

***

After escaping several savage dogs in the offices of the latter, some kind friend with lamb-like patience read the observations through, and informed him that the light he had seen was from a dark-lantern, and that that was all that there was in the whole thing.

Then, like our own alleged scientific gentleman, he undoubtedly went headlong after some other chimera or absurdity.

***

The arc light installation of the Brooklyn Bridge is a credit, not only to the graceful structure itself, but also to the United States Electric Light Company's electricians.

***

I have seen them from the Ninety-second Street Ferry, Long Island side, and also from the bay, and I must confess I never saw arc lights more uniform in intensity or steadier.

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The posts that have been selected for these lights are not only graceful, but are so arranged as to receive within them much of that exterior wiry entanglement which seems to be a part of some other systems.

***

An interesting bit of news for my friends the chemists is contained in a recent newsletter from Scotland, to the effect that Dr. Drinkwater, the lecturer on chemistry at the Edinburgh School of Medicine, has discovered that selenium is an accidental adulteration of sulphuric acid.

***

Sulphuric acid is used extensively by the refiners of the products of shale distillation, and hitherto the chief impurity to be guarded against was nitric acid.

***

But samples having been submitted to Dr. Drinkwater, he failed to find nitric acid, and yet it was certain that there was something in the sulphuric acid injurious to the mineral oil.

***

Subsequently the offender was discovered in selenium.

***

Acid containing selenium cannot be used by brass-wire workers, as it blackens the wire. The method of analyzing for selenium was described by Dr. Drinkwater in a paper read recently before the Society of Public Analysts.

***

The number of improvements recently made in galvanic batteries is quite astonishing.

***

Several very ingenious electricians have set for themselves the task of making batteries which shall be at once inexpensive, convenient and efficient.

***

I do not wish to imply by this that these newly-contrived batteries are superior to the old-fashioned standard cell, for of this I am by no means certain; and even though I were, I should prefer to have the question decided by those who have made a special study of this very important class of electrical machines, among whom I may not number myself.

***

In one of these patent cells peroxide of lead, either in powder or cakes, is placed in a porous pot, and so separated from a zinc or lead positive electrode, the electrodes being interchangeable as regards their position.

***

In another form the negative electrode of platinum or carbon is packed around with a mixture of metallic peroxides, such as those of lead or manganese, and the zinc or positive electrode is separated by a porous pot.

***

This form, it is said, may be modified by making the pot itself of carbon and filling it with a mixture of metallic peroxides and some inert substance.

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In still another form the mixture of metallic peroxide is packed between the outer vessel and the inner porous pot, while inside the latter is a mass of wire, granules, scraps, or plates of zinc.

***

The rods or plates of peroxides of lead may be surrounded by coiled zinc wire, or rings of zinc, the two electrodes being separated by wood strips.

***

In another form an electrode of carbon is permeated with the metallic peroxide by exposing it to the action of gaseous fluorhydride, then impregnating with the salt, which is afterwards decomposed by heat or chemical reaction.

***

The zinc electrode may also be built up of layers of perforated zinc sheets.

***

There has been made also an improvement in the ordinary combination of zinc and carbon, in which the carbon-rod is packed around with broken cake.

***

In the zinc compartment, the exciting solution is a one per cent. solution of sulphuric acid, or a one and one-half per cent. solution of hydrochloric acid; while in the carbon cell is a mixed liquid composed of one volume of hyponitric acid, three volumes of sulphuric (or 4½ of hydrochloric) acid, and four volumes of water.

***

The zincs in this battery are sometimes nickel-plated instead of being amalgamated.

***

In France a very superior battery has been made by covering a carbon plate, both sides, with chloride of silver and immersing it in a solution of hydrate of potassium or sodium, the hydrate being in the proportion of 30 to 40 per cent. of the weight of the water.

***

A plate of zinc is immersed in the same solution close to the carbon, which may, however, be wrapped in asbestos cloth or placed in a porous cell.

***

The battery may be revivified by plunging the carbon plate in a bath composed of nitric acid and hydrochloric acid, or chloride of sodium dissolved in water or chloro-chromate of potassium, and nitric or sulphuric acid, the object being to chloridize the metallic silver.

***

The hydrates may be dissolved in glycerine if the battery is exposed to frost.

***

One of the most efficient portable batteries that has recently been devised is a modification of the chloride of silver arrangement.

***

A short piece of copper tube has one end stopped by a cap of the same metal, and the interior being plated with silver, is subsequently covered with a layer of fused chloride of silver; the other end of the tube is closed with a cap of some insolating material, through which passes a zinc screw, holding in the interior of the tube a cylinder or tube of zinc, extending nearly to the bottom of the cell thus formed. The exciting liquid is sodium chloride (common salt) or sulphate, or zinc chloride. The wires are attached respectively to the zinc screw and to the exterior of the copper tube.

***

The public cannot, of course, be expected to know exactly to whom they owe the storage battery, so-called, and which gives so much promise of future usefulness.

***

But not infrequently there are to be seen statements of those who ought to know better, which exhibit a lack of knowledge on this point.

***

The improvement introduced by M. Faure was to get reducible plates without the great number of preliminary reversals necessary under Planté's system.

***

Planté provided oxidizable plates, but their oxidizability did not extend to any great depth, and most of the force escaped.

***

Faure decided to coat his plates with some porous peroxide, and found that minium, red-lead, and litharge were suitable for the purpose.

***

By this means a large absorbent surface was provided, and the waste occasioned by the giving off of gas from the cell was delayed, thus increasing the storage capacity of the cell by that interval.

***

The peroxide coat spunged out till all was peroxidized, and so there was no discharge till the plate was full.

***

For the positive plate, it was found best to use minium, and for the negative red-lead as a coat.

***

If the quantities of coats and liquids were properly adjusted, both plates would be filled together, but as a matter of fact this was not attained.

***

That is the Faure principle, in which there are no reversals of current, and the economy in time over the Plante or reversing system, can be estimated from the fact that a Faure cell can be prepared in about one-twelfth the time a Plante cell can be filled, while at the same time there is no essential difference in the results of the two forms of storage.

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The time and expense of production are, therefore, greatly diminished under the Faure system.

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But it is not found easy in practice to make the coating in the Faure cells adhere to the plates for any length of time.

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The red-lead or minium has no affinity for the lead steeped in the liquid and speedily peels off, and here is the difficulty.

***

The first attempt at a solution of the problem as to how the two substances could be kept together was to place porous material between the plates and then the composition was literally tied on to the plates with bands of cloth.

***

But this did not give a good chemical contact with the plate, and another difficulty was that the cloth was rapidly attacked and decomposed by the dilute sulphuric acid.

***

To prolong its life the best trousering cloth was used, and this proved very expensive and did not last long nor give a good contact.

***

Besides this, the coats and plates would not bear such shaking as they would sustain in transit by railway.

***

A further improvement was devised and consisted in putting the oxidizing coating into perforations or interstices of the metal plates themselves.

***

This was devised by Swan and Sellon almost simultaneously, Swan being actually first in point of time.

***

In the perfected battery known as the Faure-Sellon-Volckman, the lead became a grid filled with an oxidizable composition.

***

First of all cast iron moulds are prepared, scored all over like a gridiron with a net-work of straight channels.

***

Two of these matrices are put together and the molten lead is poured into them and rectangular pierced sheets of lead are cast as the result.

***

These framed grids are then filled with composition—litharge for the positive and red-lead for the negative plate, the composition being made into a pulp with diluted sulphuric acid and run in.

***

The composition adheres well to them,

and can only be removed by bending the plates back.

***

The next stage is to form cells.

***

A large number of plates are put together in a trough, all the positives and negatives being kept by themselves, and each plate is separated from the next one by a frame of india-rubber.

***

The dilute sulphuric acid is then poured in, and the plates are slowly peroxidized.

***

They gradually become blackened upon the lines of the lead-work, the centers of the holes being the last portions to change color, and the whole surfaces are in a spongy condition accessible to the liquid.

***

The plates are then stored in Faure cells ready for use, being carefully isolated by the india-rubber bands.

***

Another plan is that of pushing out the composition from certain holes, and filling them up with projecting india-rubber plugs; but if the plugs are not bent, no contact is possible under this plan.

***

The state of saturation in the liquid is ascertained by an ingenious copper balance and hygrometer.

***

The plates are made in two sizes, the one double the size of the other, and are packed together, nine positives and nine negatives in a box.

***

The small sizes of cell are the half horse-power, and the large ones the full horse-power, the term signifying, of course, such a power per hour, and combinations of cells are manufactured up to five horse-power, the only difference being in the number of plates per cell.

***

About sixteen amperes per hour can be stored in a small pair of plates, and such a pair will discharge a current for six to eight hours, giving forth 160 amperes.

Telephone Stock Quotations.

American Bell Telephone Company	272
Bay State Telephone Company	133
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National Bell Telephone Company of Maine	
New York and Pennsylvania Telephone Company	100
Northwestern Telephone Company	
Southwestern Telephone Company	68
Suburban Telephone Company	139
Southern Bell Telephone and Telegraph Company	125
Tropical Telephone Company	2¾
Central Union Telephone Company	110
Iowa Union " "	100
Missouri and Kansas Telephone Co.	100
United Telephone Company (Kansas and Missouri)	95
Bell Telephone Company, of Missouri	165
Wisconsin Telegraph Company	120

Reviews.

The fourth number of the *Telegraphers' Advocate* is the best that has been issued, and shows skill in its "make up" of news and information. A feature particularly interesting to telegraphers in their enterprise is grouping under the head of "correspondence" letters from thirteen cities in the United States, each full of interest.

The *Carpet Trade and Review* is one of the most successful class journals published in America. When we first saw it, several years ago, thirty-six or forty pages constituted its make up—of course there was good general articles and bright, spicy trade news upon these pages—but the old paper had almost grown out of our recollection. The puny child of those days has grown into a strong, healthy maturity, and with all the characteristics of ripe journalistic experience presents itself fortnightly to its readers. The issue before us contains one hundred pages, including the title-page, and if a fault can be found it is with superabundance of adver tising. This is not a fault, however, but rather a sure indication of prosperity and the measure of appreciation with which it is held by its patrons. This excellent journal is edited by William Berri and William A. Harris, and published by the Review Publishing Company, at 335 Broadway, New York.

One of the finest pieces of lithographic printing we ever saw came to us from the Cincinnati Exposition. It is their display card, printed in from ten to fifteen colors, and is elaborate in design and an elegant piece of work.

NEW PATENTS—ELECTRICAL—1883.

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JULY 10, 1883.

281,040 Armature for dynamo-electric engines; Warren P. Freeman, New York, N. Y.

281,176 Apparatus for measuring the amount of current energy received by a secondary battery; Charles F. Brush, Cleveland, Ohio.

281,202 Automatic electric-circuit breaker; Lucius J. Phelps, New York, N. Y.

280,919 Conduit for underground electric wires; James DuShane, South Bend, Indiana.

281,064 Conduit for underground lines for telegraph and other wires; William Hendley, Washington, D. C.

281,175 Current manipulator for secondary battery charging; Charles F. Brush, Cleveland, Ohio.

281,052 Dynamo-electric machine; J. Edwin Giles, Hazleton, Pa.

280,869 Electric underground cable; Frank A. Smith, Macomb, Ill.

280,906 Electric fire-extinguisher and fire-alarm system; Charles F. Buell, New Haven, Conn.

281,048 Electric carbon; Herman Frasch, Cleveland, Ohio.

281,097 Electrical exercising apparatus; William T. McGinnis, New York, N. Y.

281,223 Electrical conductor; Hiram D. Rogers, New York, N. Y.

281,224 Electrically-heated mirror; Benjamin H. Goodsell, Charles Adamson and Carl O. Hering, Philadelphia, Pa.

280,933 Galvanic battery; William W. Karschner, Washington, D. C.

280,947 Insulator for electrical conductors; Percy C. Ohl, Plainfield, N. J.

280,882 Process of treating alcoholic liquors with electricity; Anson C. Tichenor, Alameda, Cal.

281,182 Printing telegraph; Stephen D. Field, New York, N. Y.

281,117 Quadruplex telegraph; Alexander Muirhead, London, England.

281,118 Quadruplex telegraph; Alexander Muirhead and George K. Winter, London, England.

281,156 Secondary battery, or electric accumulator; Eli T. Starr, Philadelphia, Pa.

280,800 Telephone receiver; Louis J. Crossley; Halifax, County of York, England.

280,850 Tower for electric lights; Benjamin F. Orton, East Saginaw, Michigan.

280,916 Telephone and telegraph protector; Charles C. Drake, Trenton, N. J.

280,948 Telephone call; Percy C. Ohl, Plainfield, N. J.

281,000 Telephone receiver; Joseph F. Batchelor, Baltimore, Md.

281,220 Ventilating conduits for electric wires, and adjusting the wires in the same.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

The largest cable ever made on the Pacific coast was finished at the California Wire Works recently. It is 18,000 feet in length, and weighs twenty-six tons. Rolled on a shaft it makes a bundle about twenty feet in diameter and ten in depth. It is made of steel wire, and cost $20,000. The cable is for the California Street Railroad.

Manufacturing News.

Tennessee has twenty-five copper furnaces, with an annual yield of nearly three million pounds of copper.

The Norwalk (Conn.) Telephone Exchange is making good progress under Manager Lee, who is now running new wires to the lower part of the city.

At the last grand ball which took place at the Hotel of the Princess Sagan, at Paris, the gardens attached to the house were brilliantly illumined by the electric light.

The new organ factory at Middleboro, Mass., is to be located on land of Joseph L. Pease, about sixty rods northeast of Center street and between the railroad and West avenue.

A quantity of electrical apparatus useful in aërial navigation (motors, telephones, telegraphs, electric lights, etc.), has been exhibited at the Aëronautic Exposition, organized at the Palace du Trocadero (Paris), on the occasion of the celebration of the centenary of the discovery of balloons.

Last Wednesday experiments in electric lighting were made at the factory of Denis Farcot with the high-speed steam engine of that constructor. This motor, which has been described in *La Lumière Electrique*, is specially arranged to run at 300 revolutions per minute. It feeds 150 incandescent lamps, absorbing a force of 20 ohms.

Among the illuminations on the programme of the 14th of July festival at Paris, we note that of the Trocadero. A powerful electric light will issue from the grotto of the cascade. It will project its light through the sheet of water. In the Place de la Republique, where the statute of the Republic will be inaugurated, an electric light will be directed on the monument.

Mr. F. W. Jones, manager of the Union Electric Manufacturing Company, has completed his experiments on a new electric light lamp which has some new features about it, and is now prepared to sell outright electric light plants to proprietors of stores, factories, &c., who want a small number of lights.

A German has invented a safe that, on its lock being tampered with, throws open its doors, seizes and drags and locks in the burglar, and handcuffs and holds him in readiness to be conducted to the police court in the morning. The Yankee is experimenting with a set of books for the use of county officers, which, as soon as a fraudulent entry is made in them, will, by means of a clever electrical contrivance, sound an alarm on the court-house bell.

The same as at the other exhibitions, conferences and scientific congresses in which will be treated questions pertaining to electricity, will take place during the International Colonial and Exportation Exhibition in Amsterdam, which will be opened in September, and will coincide in time with the International Exhibition now in progress in that city. The Committee of the 5th Section of the latter Exhibition is charged with the direction of the conferences and scientific congresses. French has been adopted as the official language.

Mr. Collins, owner of Collins's mills in Dracut, Mass., has begun the extensive improvements to his works decided upon several weeks since. He has commenced the foundation of two mills—one about 160 feet by 58 and two stories high, and the other 170 feet by 67 and three stories high. Both are to be of brick, and are to be furnished with new machinery. The old mill is to be demolished when the new one is built, with the exception of the stone portion, which is to be used for a dye-house. Two new Swain wheels are to be put in, and one is to be located between the new mills. Mr. Collins ordered a number of new looms for his mills yesterday.

An old lady in Kalamazoo, Michigan, objected to the setting of a telephone pole on her premises, saying she wasn't going to have that thing there to telegraph everything she said all over the town.

The Fowler Rolling Mill Company have recently doubled their capacity for the manufacture of the Fowler spike, by the placing in of an additional train of rolls, a 100-horse power engine and boiler and additional furnaces. By some improvements lately made by Mr. Fowler, he is enabled to carry an old rail from the furnace and convert it into finished spikes in 14 seconds.

The Helmbacher Forge & Iron Company have just put into their extensive works in St. Louis one of Riehle Bros.' 75-ton horizontal testing machines. Messrs. J. B. Porter & Co., of Glendale, O., have purchased one of Riehle Bros.' latest improved 50,000-pound testing machines for tensile, transverse and compression strains. Also for the New Haven Wire Company one wire tester and Providence Board of Public Works one cement tester. Orders for testers are booked far ahead.

BUSINESS NOTICES.

Bradley A. Fiske, Consulting Electrical Engineer, 59 Astor House. Advice to inventors, calculations, etc.

Wanted—Telephone exchange manager. An ambitious young man, experienced both in outside and inside work, thoroughly posted on "troubles," and possessing some tact as a canvasser.

Address, with statement of age, references and salary expected, "Company," care of the ELECTRICAL REVIEW.

WANTED—An experienced telephone man of ability that can take the position of superintendent or manager, and can speak the Spanish language. Address "M. C." care of this office, P. O. Box 3329.

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The following notice has been sent out by the Western Union Telegraph Company:

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By THOS. T. ECKERT,
Acting President.

N. B.—By the laws of the State of New York, above mentioned offenses are punishable by *imprisonment for not exceeding two years.*

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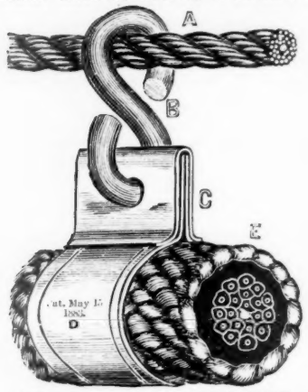

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ELECTRICAL REVIEW.

INTERNATIONAL
Electric Exhibition
VIENNA, 1883.

The Commission of the International Electric Exhibition at Vienna, 1883, gives due notice to the public that this Exhibition is to take place in the course of this year, to be opened on the **1st August,** and to be closed on the **31st October,** and cordially invite Exhibitors and Visitors. The Regulations and the blanks necessary for Applications are to be had at the **Austrian-Hungarian Consuls.** The objects to be exposed will comprise all Machinery, Apparatuses and Implements connected with Electrotechnic It will certainly afford a good opportunity to inventors to show their latest improvements. This Exhibition is greatly favored by the Austrian Government, and will be held in the Rotunda of the well-remembered Universal Exhibition of 1873. Exhibitors are requested to procure the necessary papers at once.

BOOKS.

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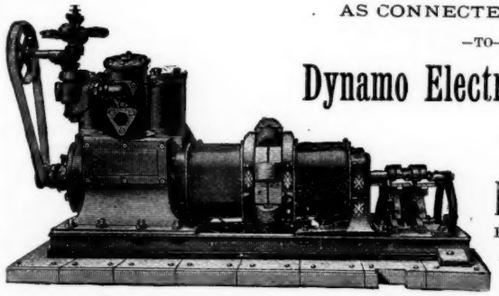

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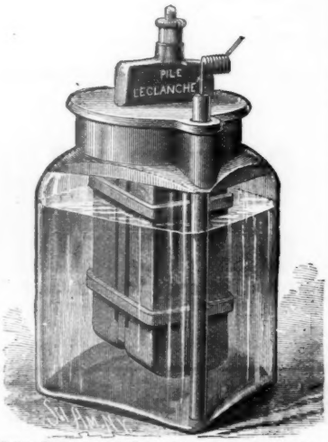

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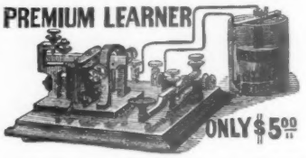

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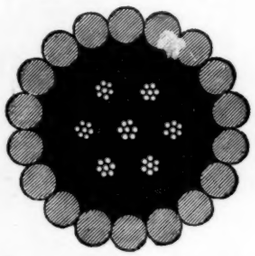

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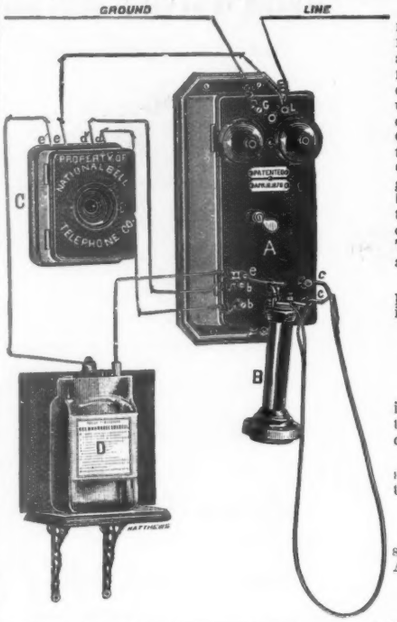

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